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VOL. 32. Ser. A. Part 12. pp. 401-435. DECEMBER, 1944.

THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

ISSUED BY THE IMPERIAL INSTITUTE OF ENTOMOLOGY.

LONDON:
THE IMPERIAL INSTITUTE OF ENTOMOLOGY,
41, QUEEN'S GATE, S.W.7.

Price 3s. net.

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UNDERHILL (G. W.). **Some Insect Pests of Ornamental Plants.**—*Bull. Virginia agric. Exp. Sta.* no. 349, 38 pp., 14 figs., 14 refs. Blacksburg, Va., 1943.

The results are given of studies on the bionomics of six insect pests of ornamental shrubs, made at a nursery near Richmond, Virginia, and of the experiments on which the recommendations for control are based.

Dichomeris marginella, F., which appears to be widely distributed in Virginia, attacks several varieties of ornamental juniper, particularly those of *Juniperus communis*; *J. sabina* and *J. chinensis* var. *pfitzeriana* appear to be immune. The presence of the larvae is indicated by large areas of dead brown leaves and twigs webbed together in autumn and spring, particularly the latter. There is one generation in the year. The eggs are laid singly or in small groups, often in the axils of the leaves on the lower part of the current season's growth. They hatched in 9–16 days in May and June 1934. The newly hatched larva spins a web in the axil of the leaf and then tunnels into the leaf and hollows it out. It continues to feed on the upper surfaces of adjoining leaves, webbing them together, and in late August or September constructs a silk cell among them in which it overwinters. Feeding is resumed in early spring, and pupation takes place in April or early May. In 1933, the prepupal and pupal periods were 6–8 and 12–17 days, respectively, and moth emergence continued for 6–7 weeks from 1st May. For small numbers of individuals, the preoviposition period was 2–12 days in 1934, and the life of males and females averaged 16·3 and 14·7 days and the number of eggs per female 132. Eggs, dead larvae and living and dead pupae were attacked by the mite, *Pediculoides ventricosus*, Newp., in the field and insectary, and some larvae and possibly pupae were apparently killed by disease. *Catolaccus aeneoviridis*, Gir., *Itoplectis conquisitor*, Say, *Pimpla* (*Ephialtes*) *aequalis*, Prov., *Bracon* (*Microbracon*) *gelechiae*, Ashm., and *Tetrastichus* sp., were reared from two collections of material, the total parasitism reaching approximately 10–15 per cent. [*cf. R.A.E.*, A **25** 549]. A spray of 3 lb. lead arsenate per 100 U.S. gals. water, preferably with the addition of an adhesive, applied thoroughly to the upper surface of the leaves in late March or early April and in August or early September, is recommended for control. Calcium arsenate may be applied as a dust, but applications should be repeated once or twice in windy and rainy weather. On small numbers of plants, stripping webs and larvae and burning them during the winter and early spring is practical.

Rhyacionia frustrana, Comst., occurs throughout Virginia, but is most abundant in the east and south. It is common in *Pinus taeda* and *P. echinata* and has seriously damaged *P. mugo*, *P. banksiana* and *P. densiflora*, but *P. rigida* is less subject to attack. Seedlings and saplings less than 6 ft. high are most severely injured. The seasonal history of this Tortricid is described; it had three generations a year and overwintered in the pupal stage, the first moths emerging early in April. The eggs are laid singly, chiefly in the axils of the leaves, and the larva usually spins a web in the axil of a leaf near the terminal bud and feeds on the tender cortical tissue before burrowing into the twig and up into the bud, in which it pupates [*cf. R.A.E.*, A **21** 353]. One or two larvae per terminal may kill only the bud, but heavy infestations may kill 6–12 inches of the shoot, and injury by the second and third generations may be so severe that the entire season's growth is destroyed. The trees are rarely killed, but light infestations check growth and cause side branching, and heavy infestations stunt the trees. Large numbers of *Lixophaga mediocris*, Aldr., *L. plumbea*, Aldr., *Campoplex frustranae*, Cushm., *Haltichella rhyacioniae*, Gah., and *Eurytoma tylodermatis*, Ashm., and smaller numbers of *Spilochalcis flavopicta*, Cress. (*delira*, Cress.) and *Hyssopus rhyacioniae*, Gah., were reared from pupae collected in 1930–33, with a few individuals of 16 other Hymenopterous parasites, a list of which is given. *Trichogramma minutum*, Ril., parasitised a fair percentage of eggs of the second generation in 1932. Recommended control measures comprise the rejection of plants with dead buds or tips hollowed out by a borer;

(1284) Wt. P12/3742 1/45 S.E.R. Ltd. Gp. 432 [A] A

cutting out and burning infested buds or tips in late July or during the dormant season ; and spraying thoroughly, twice against the second generation and twice against the third, with 3 lb. Black Leaf 155 [fixed nicotine] and 1 U.S. quart miscible oil or 1 U.S. gal. light summer oil per 100 U.S. gals. water or with 3 lb. lead arsenate and 1 U.S. pint fish oil per 100 U.S. gals.

Euonymus is frequently damaged or killed by *Unaspis* (*Chionaspis*) *euonymi*, Comst., which is widely distributed in Virginia on all species of this genus and on a number of other wild and ornamental plants. There are two generations in the year. Young of the first are usually present from the beginning of May to the end of June. Males of this generation emerged and females became sexually mature in about six weeks, and mating took place at this time, but young were not born until 4–5 weeks later. The females produced young over a period of 4–5 weeks and lived about 4 months. Young of the second generation were produced from mid-July to the end of September and were present as late as 10th October. Males emerged in about 7 weeks, from the first week in September until towards the end of November, and females became sexually mature at about the same time. After mating, the females overwintered before producing offspring, living about nine months. They contained 63–143 embryos each. The scale was preyed upon by *Chilocorus stigma*, Say, and parasitised by *Aspidiotiphagus citrinus* var. *agilior*, Berl. Lubricating oil emulsion or miscible oil in water (1 : 30) should be applied in November and again in March or April, and applications of summer miscible oil (1 : 50) or of 1 U.S. pint nicotine sulphate (40 per cent.) and 5 lb. soap flakes per 100 U.S. gals. water when the young are present in large numbers, usually in May and August, will improve control.

Argyresthia thuiella, Pack., is widespread in south-western Virginia and occurs in the Shenandoah valley, but has not been observed in the east of the State. It attacks arbor-vitae [*Thuja occidentalis*] and all the cultivated species of *Thuja*, and another leaf-miner, *Recurvaria thujaëlla*, Kearf., is sometimes associated with it. The eggs were laid singly in narrow crotches of leaves and twigs over a period of 4–5 weeks, maximum oviposition occurring at the end of May and during the first half of June. The larvae hatched in 14–18 days and burrowed into the leaves. They continued to feed until late autumn, overwintered in the mines and pupated there during March–May. The pupal stage lasted 3–5 weeks, and moth emergence began in May. The injury caused by the larvae, which consists of browning of the foliage, is most conspicuous in late winter and spring ; older larvae commonly leave their burrows and make new ones, and they often cut into the cambium of the twigs and may completely girdle them, causing them to die beyond the point of injury. No parasitised eggs were found, but larval parasitism reached 64·4 per cent. in 1939 and 56 per cent. in 1940. *Pentacnemus bucculatricis*, How., was the most common parasite, a species of *Chrysocharis* and *Derostenus fullawayi*, Crwf., were numerous and *Apanteles epinotiae*, Vier., an undescribed species of *Apanteles*, *Microgaster zonaria*, Say, *Spilochalcis albifrons*, Walsh, and species of *Elachertus*, *Habrocytus*, *Phaedroctonus* and *Zagrammosoma* were of minor importance. A spray of 2 per cent. medium summer oil should be applied three times at ten-day intervals, beginning when the moths become abundant ; its effectiveness is increased by the addition of nicotine sulphate (1 : 800). If the moths are numerous, a 4 per cent. nicotine dust may also be applied.

Psylla buxi, L., seems to be generally distributed on box [*Buxus*] in Virginia and to have only one generation a year. The eggs were found beneath bud-scales in winter and adults on the plants in February, March and April. The nymphs hatched mainly during the first three weeks in April and began feeding on new unfolding leaves, many of them entering the buds before the leaves separated. They became adult during May and early June. Both nymphs and adults suck the sap from the leaves, causing them to curl, though this is not evident on tree box, and growth is also checked. The first typical curling of infested leaves

was observed about the third week in April. Satisfactory control was obtained with a spray of 1 U.S. pint nicotine sulphate and 1 U.S. gal. miscible summer oil or 5 lb. soap per 100 U.S. gals. water, applied soon after the eggs began to hatch or just as the new leaves began to unfold, and again ten days later.

Phytomyza ilicicola, Lw. (*ilicis*, auct.) is the most injurious insect attacking American holly (*Ilex opaca*) in Virginia. The larvae make mines in the upper surface of the leaves, in which they overwinter and pupate [*cf.* **31** 480]. Infested leaves do not wilt in the first season, but most of them are shed in the following spring; a heavy attack retards the growth of the tree. The larval stage normally lasts from mid-May to mid-March at Richmond. The adults emerged mainly in April and were not active at temperatures below 70°F.; most of them died within 8–10 days under cage conditions. Parasitism occurred in the egg or very early larval stage, 6–60 per cent. of the larvae and pupae being parasitised. *Opius striativentris*, Gah., was the most important parasite, *Pleurotropis lithocolletidis*, Ashm., and *Closterocerus tricinctus*, Ashm., were fairly abundant and a species of *Pnigalio* and an undescribed Pteromalid were present in small numbers. A spray of 1 quart nicotine sulphate with 2 quarts fish oil or 1 pint Vatsol [10 per cent. aqueous dioctyl ester of sodium sulphosuccinate] per 100 gals. water should be applied 2–3 days before the peak of adult emergence and twice more at intervals of 7–10 days. It is also recommended that infested trees should be defoliated in winter by spraying them with a solution of 1 lb. copper sulphate in 5–8 U.S. gals. water, which was found to cause the leaves to turn yellow and drop in about ten weeks; the leaves should be collected and burnt. Holly trees with blotch mines on the upper surface of the leaves should not be planted.

Reinhard (H. J.). **Hibernation of the Boll Weevil.**—*Bull. Tex. agric. Exp. Sta.* no. 638, 23 pp., 3 figs. College Station, Tex., 1943.

An account is given of studies in progress in Texas from 1923 to 1942 on the hibernation of adults of *Anthonomus grandis*, Boh., with reference to the influence of its survival on damage to cotton. The data were obtained from observations on weevils kept in cages, usually under open field conditions. The cages which are described, contained dry weeds, Spanish moss [*Tillandsia usneoides*] or Johnson grass [*Sorghum halepense*] as shelter. In general, the weevils were in shelter from November until May; they did not hibernate completely, but resumed activity during warm spells. In the field, they normally become active about 1st March, and in seasons when survival was high emergence from shelter in the cages was not completed until July. The percentages that survived under open field conditions varied from 19·22 in 1941 to 0·3 in 1930, the average for 18 seasons (1925–42) being 6·04, and were about 10–19 when the minimum temperature was 26°F. or higher and less than 1 when it was as low as 0–15°F. In cages placed in woods in 1923–25, inclusive, the rate of survival was about twice as high as under open field conditions. Among weevils placed in the cages during the first and second halves of October, survival averaged 2·8 and 8·1 per cent., respectively, but it showed no significant increase when they were placed in the cages in November. Cotton stalks should therefore be destroyed before 15th October, so that the weevils die of starvation or enter hibernation in a weakened condition.

It was found that emergence from hibernation depends mainly on temperature and rainfall and is usually protracted and irregular from year to year. Some weevils emerge at temperatures of 55–60°F., which normally occur in March, but many return to shelter during cold spells, and some of these find more protected sites, as a result of which their ultimate emergence is delayed. Weevils in the most protected sites did not leave them until temperatures of 75–80°F. had prevailed for 4–5 weeks. For this reason, delayed planting is not completely successful in preventing damage. Survival after mild winters was lower when

there were many days in March on which the mean temperature exceeded 75°F. than when there were few warm days in March. Once emergence from shelter has begun, the rate at which it proceeds is influenced by rainfall, frequent showers following warm sunshine providing the most favourable conditions. It reaches a peak in the latter half of May, when cotton fruits are generally abundant, and in south-central Texas is generally complete by the end of June. Early in the season, infestation is usually severe on cotton nearest to wooded areas, fence rows and other shelter, but weevils that find plants on which squares are available tend to remain on them and field records showed that the average distance covered during the first week of activity was less than 100 ft. from the point of entry into the field. As the supply of squares becomes limited, the weevils move to fresh plants by crawling or by means of short flights [*cf. R.A.E.*, A **21** 72–73]. During the early part of the growing season, when squares are scarce, dispersal may be more rapid.

The amount of damage caused by the weevils during the season is not directly related to the percentage that survives the winter, but depends primarily on weather conditions. In 1935 and 1940, frequent showers during the early growing season followed light survival and damage was widespread, but in 1931, when survival was unusually high, injury was effectively checked by prolonged hot, dry weather in May-July. Forecasts of damage based on survival alone are therefore unreliable.

McAlister jr. (L. C.), McCubbin (W. A.), Pfaffman (G. A.), Owrey (W. T.), Taylor (H. G.) & Berryhill (I. W.). **A Study of the adult Populations of the West Indian Fruitfly in Citrus Plantings in Puerto Rico.**—*Bull. P. R. [fed.] Exp. Sta.* no. 41, 16 pp., 1 fig., 9 refs. Washington, D.C., 1941. [Recd. 1944.]

The following is almost entirely based on the authors' introduction and summary. *Anastrepha suspensa*, Lw. (*unipuncta*, Seín) and *A. mombinpraeoptans*, Seín, the two species of the genus known to occur in Porto Rico, attack fruits of *Citrus* under cage conditions, and a few *Citrus* fruits containing larvae of *A. suspensa* have been found in each year since 1931, but the relation of these Trypetids to *Citrus* was not clearly understood. Under natural conditions *A. mombinpraeoptans* breeds chiefly in fruits of mango and *Spondias* spp. (hog plums) and *A. suspensa* in those of *Eugenia* (*Caraphyllus*) *jambos* (rose apple) and guava. Records from other fruits [*cf. R.A.E.*, A **22** 151] include *A. mombinpraeoptans* from *Anacardium occidentale* (cashew) and *A. suspensa* from *E.* (*Jambosa*) *malaccensis* (Malay apple) and *E. uniflora* (Surinam cherry). A study of the populations of adults in *Citrus* groves was made between April 1937 and June 1938 by means of glass bait-traps in six groves in the western mountainous area and six in the main *Citrus*-growing belt. It was found that both species were present in the groves, particularly those in the main belt, throughout the year ; their numbers showed considerable seasonal fluctuations, and did not apparently depend on their development in *Citrus* fruit or on any attraction offered by it. Two females of a fruit-fly referred to as *Anastrepha* new species " F " were trapped in the mountainous area during the summer of 1937 ; this species has hitherto been recorded only from Florida.

About two-thirds of all the adults of *A. suspensa* taken on *Citrus* in the mountains were caught between mid-June and the end of July, which corresponds with the fruiting season of *E. jambos*, and rather more than half those taken in the main belt were caught between the latter part of July and mid-November, which corresponds with the combined fruiting seasons of *E. jambos* and guava. The occurrence of *A. mombinpraeoptans* on *Citrus* in both areas appeared to be associated with the principal fruiting season of mango and *Spondias*, in or near he plantings. Localised larval infestations were occasionally found on grapefruit about a mile from any known preferred host-fruits, so that the adults

must migrate for considerable distances, but there appeared to be a correlation between the number of adults of each species in the *Citrus* plantings and the number on the principal host-fruit trees. At no period did the populations of either on *Citrus* exceed those on the latter and they were infinitesimal during most of the year. *A. suspensa* is not known to breed in mango in Porto Rico, but the adults were generally more abundant in mango trees than in *Citrus*. The distribution of both species in *Citrus* groves was considerably affected by the presence of mango and other trees in the immediate vicinity, but these could not be regarded as the source of all the flies trapped in the groves, to which they probably migrated for shelter and protection. Both species bred abundantly in their preferred host-fruits, but relatively few *Citrus* fruits were attacked and the average number of immature stages per fruit was low. Of a total of 1,528 flies reared from *Citrus* fruits in 1932–38, only five were identified as *A. mombinpraeoptans*. The occurrence of both species in close association in *Citrus* groves indicates a general similarity in their migratory habits. Infestations of *Citrus* fruits by *A. suspensa* were associated with a small but definite influx of the adults into the groves in the mountainous area in late February and into those in the main *Citrus* belt about 1st March. These attacks, which occurred sporadically from March to May, disappeared soon after the adult populations decreased, at a time when the fruits were in excellent condition for infestation. The number of fruits infested was negligible from a commercial standpoint, and on the basis of this survey *A. suspensa* is considered to be of no importance as a pest of *Citrus*.

NARAYANAN (E. S.). **On the Bionomics and Life-history of** *Coniopteryx pusana* **Withycombe, Coniopterygidae (Neuroptera).**—*Indian J. Ent.* **4** pt. 1 pp. 1–4, 10 figs., 1 ref. New Delhi, 1942. [Recd. 1944.]

Descriptions are given of the immature stages of *Coniopteryx pusana*, Withycombe, which preys on the eggs of *Pyrilla* on sugar-cane at Pusa [*R.A.E.*, A **26** 241]. Adults appeared in small numbers in the field in the last week in July and were seen feeding on honey-dew produced by *Pyrilla* and Aleurodids on sugar-cane during August and September. The larvae were observed attacking egg-masses of *Pyrilla* from August onwards. The life-cycle occupied four weeks in July–September, when the mean minimum and maximum temperatures are about 79·5 and 81·5°F., respectively, and the average relative humidity is 86·6 per cent., and eight weeks in November–February, when the corresponding temperatures and humidity are 50·5 and 76°F. and 82·6 per cent.

CHERIAN (M. C.) & NARAYANASWAMI (P. S.). **The Biology of** *Microbracon chilonis* **Viereck—a larval Parasite of** *Chilo zonellus*, **Swin.**—*Indian J. Ent.* **4** pt. 1 pp. 5–7, 6 figs., 2 refs. New Delhi, 1942. [Recd. 1944.]

Bracon chinensis, Szépl. (*Microbracon chilonis*, Vier.), of which *B.* (*M.*) *chilocida*, Ram. Ayyar [*R.A.E.*, A **16** 479] is stated to be a synonym, is an ectoparasite of the sorghum borer, *Chilo zonellus*, Swinh., in Madras. The immature stages are described. In the laboratory, the adults paired soon after they emerged, and the preoviposition period lasted 2–11 days. The females oviposited on host larvae within stalks of sorghum or maize, but not on naked larvae, and laid 1–12 eggs on any part of the body of the host. The maximum number laid by a laboratory-reared female was 61, but 84 were deposited by one collected in field. The larvae hatched after one day, fed on the host for three, and then spun cocoons. The prepupal and pupal stages were completed in 3–5 and 5–7 days, respectively. When supplied with sugar solution, male and female adults survived for averages of 14 and 16·5 days and maxima of 59 and 55 days. Parthenogenesis occurs, the progeny being males, but parthenogenetic females oviposit earlier and lay fewer eggs than fertilised ones. In the

field, *B. chinensis* was also found parasitising larvae of *Proceras* (*Argyria*) *sticticraspis*, Hmps., and in the laboratory it was successfully reared on larvae of *P. sticticraspis*, *P.* (*Diatraea*) *venosatus*, Wlk., *Corcyra cephalonica*, Staint., and *Galleria mellonella*, L., though the last two were parasitised less readily.

KAPUR (A. P.). **Bionomics of some Coccinellidae, predaceous on Aphids and Coccids in North India.**—*Indian J. Ent.* **4** pt. 1 pp. 49–66, 17 figs., 25 refs. New Delhi, 1942. [Recd. 1944.]

In view of the importance of predacious Coccinellids in the natural control of the insects they attack, and the successful utilisation of certain species against Coccids in various countries, a study was made of the bionomics of *Adonia variegata*, Goeze, *Brumus suturalis*, F., and *Scymnus quadrillum*, Motsch., which are common in northern India, and a detailed account of the results is given, together with descriptions of all stages of each species and notes on its distribution. All three prey on Aphids and Coccids, and *B. suturalis* also attacks Aleurodids, Psyllids and mites. *A. variegata* is confined to northern India, where it is widely distributed, and feeding records indicate that both adults and larvae are useful predators. The life-cycle was completed in 16·2 days in the insectary, where the mean temperature was 29–34·6°C. [84·2–94·28°F.], and in 12·3 and 19·6 days at constant temperatures of 32°C. [89·6°F.] and 25°C. [77°F.], respectively. In the Delhi area, the larvae were parasitised by *Homalotylus flaminius*, Dalm., from the end of April, but were not reduced to any great extent, and a few pupae were parasitised by *Parachrysocharis* sp. in April–May. As this Coccinellid appears to have 6–8 generations a year and its oviposition rate is high, it could probably be reared on a large scale under insectary conditions. Adults kept at 16 and 13°C. [60·8 and 55·4°F.] survived for over two months without food.

B. suturalis occurs throughout India and is fairly common throughout the year except in extremes of climate. The life-cycle occupied 25·3 days in April–June and 32·7 in August–October, when the respective mean temperatures were 33·7 and 30·6°C. [about 92·7 and 87°F.]. *H. flaminius* parasitised the larvae to a slight extent at Delhi. *S. quadrillum* occurs in Ceylon and Formosa, is common in the Punjab and Delhi, and has also been recorded from Bihar. The adults attack both Aphids and Coccids, but the larvae were observed feeding only on Aphids. The life-cycle occupied 26·1 days in August–September and 34·5 in October–November, at mean temperatures of 31·6 and 25°C. [about 89 and 77°F.]. and there appear to be three generations a year. The larvae were attacked by four parasites at Delhi, but they do not appear until October. Parasitism by *H. terminalis*, Say, which is recorded from India for the first time, *H. terminalis californicus*, Gir., and another species of *Homalotylus* believed to be undescribed was as high as 42 per cent. at the end of November. The other parasite was a species of *Pachyneuron* that is also believed to be undescribed.

NAZEER AHMAD JANJUA. **On the Biology of *Euzophera punicaeella* Moore in Baluchistan.**—*Indian J. Ent.* **4** pt. 1 pp. 67–75, 5 refs. New Delhi, 1942. [Recd. 1944.]

Records of injury to plants by species of *Euzophera* in various countries are cited from the literature, the egg, six larval instars and pupa of *E. punicaeella*, Moore, are described, and a brief description of the adult is quoted. The larvae of this Pyralid normally infest fruits of pomegranate in Baluchistan ; they are occasionally found in apples, pears and quinces attacked by the codling moth [*Cydia pomonella*, L.], in which, however, they are only secondary pests [*cf. R.A.E.*, A **28** 511]. They enter young pomegranate fruits through the side or at the blossom-end and older ones through the crack that usually appears

along one side of the half-grown fruit. The thin-skinned seedless variety of pomegranate is the one most heavily attacked, but the loss for all varieties is estimated at about 30 per cent. The eggs are laid, usually singly, on the leaves and fruit, and the newly-hatched larvae sometimes feed a little on the leaves before entering the fruits. Full-fed larvae of the overwintering generation hibernate in cocoons in loose bark, tunnels of the Quetta borer [*Aeolesthes sarta*, Solsky] or other sheltered places, but those of the other generations usually pupate in the fruits.

Observations in the Quetta Valley in 1937–40 showed that four generations were completed in the year. Details are given of the dates of occurrence of the successive stages of each generation in each of the four years, and of the periods they required for development. The latter did not vary very much from one generation to the next ; the range of periods in days were 3–9 for eggs, 19–31 for feeding larvae, 2–5 for larvae in cocoons (except for the hibernating generation) and 4–21 for pupae. Adults of the overwintered generation oviposited between 29th March and 5th May. Females under observation laid from 137 to 491 eggs. The larvae were heavily parasitised by a Braconid of the genus *Apanteles*.

Rahman (Khan A.) & Dalbir Singh. **Studies on " Dead-hearts " caused by different Species of Sugarcane Borers in the Punjab.**—*Indian J. Ent.* **4** pt. 1 pp. 77–85, 4 figs., 8 refs. New Delhi, 1942. [Recd. 1944.]

The dead-hearts of sugar-cane attacked by moth borers in the Punjab are composed of varying numbers of leaves, which, in the case of the more important borers, depend on the species responsible for attack. This provides a useful index for the rapid identification of the borers infesting large areas, and descriptions are accordingly given of the dead-hearts caused by *Scirpophaga nivella*, F., *Proceras* (*Argyria*) *sticticraspis*, Hmps., and *Chilo trypetes*, Bisset, which are the most important species in the Punjab, and by an unidentified species of *Proceras* (*Diatraea*) and *Emmalocera depressella*, Swinh. The dead-hearts due to the two species of *Proceras*, unlike those due to the other species, can readily be pulled out, leaving a cavity, and the base of the dead-heart has an offensive odour. They are greyish-white in colour and are composed of the leaf spindle (central unfolded leaves) and first and second leaves in the case of *P. sticticraspis* and the leaf spindle and first to fourth leaves in that of the unidentified species. Those caused by *E. depressella* resemble those caused by *P. sticticraspis*, but cannot be pulled out. Dead-hearts caused by *C. trypetes* are dull white in colour and are composed of the leaf spindle and the first six leaves, and those caused by *S. nivella* are dark red and composed only of the leaf spindle and first leaf. In addition, the mid-ribs of the leaves on plants attacked by *S. nivella* are streaked with red, small holes (shot-holes) are present on the first four leaves, arranged in parallel rows across their width, and the unaffected leaves are darker in colour than those on uninfested plants.

Short Notes and Exhibits.—*Indian J. Ent.* **4** pt. 1 pp. 87–95, 2 refs. New Delhi, 1942. [Recd. 1944.]

H. S. Pruthi & V.P. Rao (pp. 87–88) give a list of the Coccids that attack sugar-cane in India, with notes on their distribution there. Those recorded from India for the first time are *Lepidosaphes sacchari*, Hall, in the United Provinces, Bihar, Bengal and Madras, *Odonaspis saccharicaulis*, Zehnt., and *Aclerda distorta*, Green, in Madras, and *Aspidiotus* (*Temnaspidiotus*) *kellyi*, Brain, at Delhi. The others are *Duplachionaspis divergens*, Green, and *Antonina indica*, Green, which are recorded for the first time on sugar-cane, *Aspidiotus* (*Aonidiella*) *glomeratus*, Green, *Ripersia sacchari*, Green, *Trionymus sacchari*, Ckll., *Pseudococcus saccharicola*, Takah., which has apparently been

recently introduced into India, *P. saccharifolii*, Green, *Aclerda japonica*, Newst., *A. japonica* var. *inermis*, Green, and *Icerya pilosa* var. *nardi*, Green.

Shumsher Singh (pp. 88–89) states that in observations on cotton of five varieties in Burma in 1937–39, the highest yield was obtained from the plots most heavily infested with *Pempherulus affinis*, Faust. These results were found to be statistically significant, whether the comparison was made between the most severely infested variety and the others or between plots of one variety. The increased yield is attributed to the reduction in the supply of water and nutrient salts taken in by the plant as a result of larval tunnelling, which checks vegetative growth and induces the production of flowers and is sometimes deliberately brought about by cultural methods. Very few plants suffered seriously as a result of attack after they were two months old, and the author suggests that the burrows are not moist enough to be suitable for bacteria or fungi and that the stems are seldom sufficiently weakened to break under high winds. Plants less than two months are usually killed by infestation, but such early attack is very rare.

E. J. Vevai (pp. 89–90) reports that potatoes at Delhi were severely affected with hopperburn as a result of feeding by *Empoasca punjabensis*, Pruthi, in 1941–42. The symptoms, in order of appearance, were the development of etiolated spots and patches on the leaves, browning, rotting of the leaf margins and leaf tips, and the death of the leaf. Attack was local, and the Jassids showed some varietal preference. Month-old shoots were attacked by the adults in November, but the damage did not become conspicuous until the end of December. Eggs were laid on the leaf-veins. The five nymphal instars were completed in 19–21 days at average maximum and minimum temperatures of 65 and 60°F., respectively, and in 17 days at 71 and 65°F.; the adults survived 7–15 days. Both nymphs and adults occur on the lower surface of the lower leaves; the nymphs do not migrate and are consequently the more injurious. Other food-plants of this Jassid [*cf. R.A.E.*, A **29** 266] on which hopperburn developed were brinjal [*Solanum melongena*], lucerne, tobacco, tomato and safflower [*Carthamus tinctorius*].

Kanwal K. Nirula (p. 90) records *Trypanea stellata*, Fuessly, for the first time from India, where it infested 25–30 per cent. of the flowers of *Calendula officinalis* in a nursery at New Delhi in October–December 1941. As a result of attack, the opening of the flower buds is hindered or prevented, and the flower heads shrivel or droop and dry up; no seed is produced by infested flowers. The adults are active throughout the day; eggs are deposited on the buds or between the florets of the open buds in groups of 4–20. Pupation takes place in the flowers and in the soil. The egg, larval and pupal stages occupy 1–2, 5–12 and 6–40 days, respectively, and the adults live for 8–22 days.

S. Pradhan and R. Mennon (p. 91) report that the Pyrrhocorid, *Antilochus coqueberti*, F., was observed preying on *Dysdercus cingulatus*, F., on cotton at Delhi and Karnal in November and early December, when it suddenly disappeared.

C. K. Samuel (pp. 92–93) gives an account of two undescribed Scelionids, *Liophanurus* [*samueli*, Mani (**32** 410)] and *Tiphodytes* sp., parasitising the eggs of *Bagrada cruciferarum*, Kirk. (*picta*, F.), in a field of crucifers at Delhi. The eggs of this Pentatomid are deposited in groups of 15–75 in loose soil at a depth of about ¼ in. Newly hatched nymphs and large numbers of adult parasites were observed emerging from the soil from the first week in March until early May. *Liophanurus* parasitised about 15 per cent. of the eggs present in the middle of March, and a maximum of 25 per cent. by the end of April. The females were three times as abundant as the males in the laboratory, and, when given host eggs, oviposited in 20 per cent. of those in soil and 30 per cent. of those that were not covered. The life-cycle occupied six days, which is almost the duration of the egg stage of the host, and the parasite became less abundant

in May. *Tiphodytes* sp. emerged in the field in the first week of May. Parasitism reached 18–20 per cent., and the ratio of males to females was 2 : 3. In the laboratory, a single female parasitised 25 per cent. of host eggs laid on the soil and 22 per cent. of those in it. The incubation period of the parasite eggs lasted 4–5 days, and the life-cycle occupied 12. In the absence of cruciferous plants, *Bagrada* and *Tiphodytes* bred in compost heaps ; both decreased in numbers from early June.

B. D. Gupta and R. L. Garg (p. 93) state that *Chilo trypetes*, Bisset, which appears to feed only on sugar-cane, occurs mainly in the Dehra Dun and Saharanpur districts in the United Provinces. It is injurious from the end of June until late August and hibernates from September to mid-June. First-generation larvae are present in June–July and bore in the stems 3–4 ft. above the ground ; they enter through a bud and tunnel spirally upwards. Second-generation larvae are present in August–September and tunnel downward to the root. Infestation is most severe on swampy ground and in fields previously under rice ; the most susceptible varieties are EK 28, CO 213 and CO 356. The removal of stubble after harvest is suggested for control.

P. L. Chaturvedi (p. 93) reports that in observations on the four moth borers so far known to attack sugar-cane at Cawnpore, *Scirpophaga nivella*, F., was the most abundant. It was most active in September–October, but mortality due to parasitism was high among larvae in the top shoots and in February 1942 reached rather more than 75 per cent. *Proceras* (*Argyria*) *sticticraspis*, Hmps., was next in importance, but its incidence was relatively low and it was most abundant in young canes. *Emmalocera depressella*, Swinh., occurred chiefly in young canes and was scarce in January–February, 1942. A few larvae of *Sesamia* sp. were collected during these months.

S. L. Perte (p. 94) gives notes on *Anthrenus vorax*, Waterh., which is the commonest pest of animal fibres in India. Eggs laid in March–April hatched in about a month ; the young larvae quickly succumb if food is not available. Larvae were successfully reared in the dark at 80–95°F. and a relative humidity of 70–80 per cent. when fed upon materials composed of keratin, of which wool was preferred owing to its hygroscopic properties, but not when fed on cellulose. Impregnation of woollen fibres with a toxic solution such as dinitro-α-naphthol or a proprietary moth-proofing preparation is the most effective control measure, but exposure to light, cold storage, sterilisation by heat and fumigation with hydrocyanic acid gas or paradichlorbenzene were also successful, and naphthalene and the leaves and extract of neem (*Melia azadirachta*) were of some value in preventing damage.

Pritam Lal Sharma (p. 95) states that a Sphegid of the genus *Palarus* has recently been observed to kill large numbers of honey-bees (*Apis indica*, F.) at Lyallpur.

Nazeer Ahmad Janjua. **On the Biology of *Anarsia lineatella* Zeller in Baluchistan.**—*Indian J. Ent.* **4** pt. 2 pp. 137–144, 11 refs. New Delhi, 1942. [Recd. 1944.]

An account, based on observations in the Quetta Valley in 1937–40, is given of the bionomics of *Anarsia lineatella*, Zell., in Baluchistan, where it is a fairly common pest of stone-fruit trees. The immature stages are described, and a description of the adult is quoted. The larvae feed on the pith and inner bark of twigs of peach, nectarine, plum and apricot, as a result of which the twigs dry up and fall. Each larva attacks several twigs. Serious injury results when the terminal twig of a young tree is attacked, and such trees may be destroyed by three or four larvae. The fruits are also infested, but serious fruit injury is confined to nectarines and particular varieties of the other stone fruits. The

eggs are laid on shoots, twigs and fruits, and the larvae pupate under flimsy webs in cracks in the bark, curled leaves or other shelter.

There are three overlapping generations a year in the Quetta Valley, and the larvae hibernate in the third of their six instars. Adults of the overwintered generation oviposited between 2nd May and 14th June. The larvae hatched in 6–11 days and pupated between 18th June and 21st July. The pupal period lasted 9–14 days. First-generation adults emerged between 30th June and 3rd August, and oviposited between 2nd July and 6th August. The larvae hatched in 4–8 days and pupated between 3rd August and 9th September. The pupal period lasted 6–10 days. The second-generation adults emerged (and oviposited) between 12th (15th) August and 14th (18th) September. The third-generation larvae hatched between 24th August and 27th September, fed for about four weeks and then constructed hibernaculae, which are described, beneath the outer bark. The dates on which they reappeared in spring ranged from 30th March to 4th April, and all had left the hibernaculae by 30th April. Pupation began on 20th April. Adults of all generations lived for about a week, and the average number of eggs deposited by a female of each ranged from 143·7 to 169·5.

The larvae were heavily parasitised by *Brachymeria intermedia*, Nees.

Mani (M. S.). **Studies on Indian parasitic Hymenoptera. II.**—*Indian J. Ent.* **4** pt. 2 pp. 153–162, 23 figs., 3 refs. New Delhi, 1942. [Recd. 1944.]

The nine new species described include *Liophanurus samueli*, reared from the eggs of *Bagrada cruciferarum*, Kirk. (*picta*, F.) at New Delhi [*cf. R.A.E.*, A **32** 408], *Alaptus ramakrishnai*, from mealybugs on coconut in Madras, and *Pseudogonatopus pyrillae* from nymphs of *Pyrilla* spp. in the Punjab and United Provinces. *Tetrastichus xanthomelaenae*, Rond., was reared from eggs of a species of *Galerucella* at Delhi in 1942 and is here recorded in India for the first time.

Lal (K. B.). **Description of two new and Redescription of a third Species of *Apanteles* (Braconidae) from India.**—*Indian J. Ent.* **4** pt. 2 pp. 163–166, 3 refs. New Delhi, 1942. [Recd. 1944.]

Descriptions are given of both sexes of *Apanteles pusaensis*, sp. n., reared from larvae of *Sylepta lunalis*, Gn. [*cf. R.A.E.*, A **32** 394, 395] and *A. balteatae*, sp. n., from larvae of *S. balteata*, F., both at Pusa, and *A. flavipes* f. *chilonis*, Munakata (*chilocida*, Vier.), from larvae of *Perigea capensis*, Gn., in the Central Provinces. The last named was found in Burma in 1939, but this is the first published record of its occurrence in the Indian Region.

Ramakrishna Ayyar (T. V.). **A Nettle Grub Pest of the Banana Plant in South India (*Miresa decedens* Wlk.).**—*Indian J. Ent.* **4** pt. 2 pp. 171–172. New Delhi, 1942. [Recd. 1944.]

Banana trees along the Malabar Coast are not severely attacked by insects, though *Cosmopolites sordidus*, Germ., *Prodenia litura*, F., *Stephanitis typicus*, Dist., and *Heliothrips kadaliphila*, Ram. Ayyar & Marg., occur sporadically as local pests. In 1940 and 1941, however, bananas on a plantation on the south-eastern border of the Malabar District were damaged by the Limacodid, *Miresa decedens*, Wlk. Injury first appeared as irregular holes of varying size in the leaves; the larvae, which are briefly described, fed by night and sheltered by day in the grooves between the stems and the petioles. When fully-grown, they pupated within spherical cocoons attached to the lower part of the stem and often below the soil level. Pupation occurred in September–October, and the

adults emerged in the following June or July, so that there can be only one generation a year. The larvae were present in June 1942, but were less abundant than in the previous two years.

Other Limacodids that are injurious in India include *Parasa lepida*, Cram., on many plants, including castor [*Ricinus communis*] mango, coconut, wood-apple [*Feronia limonia*] and occasionally banana, *Contheyla rotunda*, Hmps., on tea and coconut in Malabar, *Natada nararia*, Moore, on coconut, *Altha nivea*, Wlk., on castor in South India, and species of *Thosea* and *Belippa* on tea in hill districts of South India and Assam.

Deoras (P. J.). **Description of and biological Notes on a new Species of Syrphidae from India.**—*Indian J. Ent.* **4** pt. 2 pp. 217–219, 3 figs., 2 refs. New Delhi, 1942. [Recd. 1944.]

The author describes *Xanthogramma pruthii*, sp. n., from adults of both sexes collected at Delhi in 1938, and gives notes on the appearance of the larvae and pupae. Eggs of this Syrphid collected in November 1941 from the lower surface of leaves of *Luffa graveolens*, where they were laid among groups of *Myzus persicae*, Sulz., hatched in 3–4 days, and the larval and pupal stages were completed in 12–15 and 14–17 days, respectively. A single larva was observed to destroy as many as 484 Aphids in four hours. The adults survived for 25 days when provided with honey solution and mated a week after emergence.

Muliyil (J. A.) & Lakshmanan (K.). **The Effects of conserving healthy and parasitised Eggs of *Pyrilla* spp., in wire Gauze Cages on the Population of the Pest and its Parasites.**—*Indian J. Ent.* **4** pt. 2 pp. 221–223. New Delhi, 1942. [Recd. 1944.]

The destruction of egg-masses of *Pyrilla* on sugar-cane, which is generally practised as a control measure, may have harmful results, since some of the eggs are invariably attacked by one or more of the parasites, *Tetrastichus pyrillae*, Crwf., *Ooencyrtus pyrillae*, Crwf., *Ageniaspis pyrillae*, Mani, *Cheiloneurus pyrillae*, Mani, and *O. papilionis*, Ashm., and parasitism may be as high as 60 per cent. In northern India, *A. pyrillae*, *T. pyrillae* and *C. pyrillae* breed in regular sequence in the egg-masses of the generation of *Pyrilla* that is present after the monsoon. The authors therefore suggest that egg-masses, including those in leaf-sheaths, should be placed in cages of wire gauze having 900 meshes per sq. inch so that the emerging parasites, but not the nymphs of *Pyrilla*, can escape, and that the cages should remain in the field for 10–12 days, when all parasites present would have completed their development. In a preliminary trial of this method, the percentages of eggs parasitised increased in ten days from 25·7 to 59·8 in the leaf sheaths and from 68·6 to 73·4 on the leaves. A month later, the percentage in the leaf sheaths showed no appreciable change, but that on the leaves had fallen to 63·3. This fall is explained by the decrease on the approach of winter in the numbers of *T. pyrillae*, which is mainly responsible for parasitism on leaves, and its replacement by *C. pyrillae*, which attacks eggs in the leaf sheaths.

Krishna Iyer (P. N.). *Aprostocetus krishnieri* **Mani—an important internal Parasite of the *Amarantus* stem boring Weevil, *Hypolixus truncatulus* (Boh.) in South India.**—*Indian J. Ent.* **4** pt. 2 pp. 225–232, 5 figs., 5 refs. New Delhi, 1942. [Recd. 1944.]

The results are given of a study of the bionomics and morphology of *Aprostocetus krishnieri*, Mani [*cf. R.A.E.*, A **32** 393], a Eulophid endoparasite of the larvae of *Hypolixus truncatulus*, F., in stems of *Amarantus* which is abundant in the neighbourhood of Coimbatore. The distribution of the genus

Aprostocetus and the hosts of other species of it are briefly reviewed from the literature, and the immature stages of *A. krishnieri* are described in detail. The eggs are laid in groups of 2–5 in young larvae of the weevil; up to 38 occurred in a single larvae. The parasite larvae at first feed mainly on the fat-body and on the fluid in the haemocele cavity of the host, and later attack the internal organs. When fully-grown, they break through the cuticle of the host and pupate in its tunnel. The egg, larval, prepupal and pupal stages occupy 12–16 hours, 5–7 days, 6–8 hours, and 6–11 days, respectively. The females survived for a maximum of 30 days when fed on sugar or honey solution, but the males did not live for more than a week. The ratio of males to females was about 21 : 79, and in some cases all the adults emerging from a single host were females.

Short Notes and Exhibits.—*Indian J. Ent.* **4** pt. 2 pp. 233–239. New Delhi, 1942. [Recd. 1944.]

A. R. Ansari (p. 233) states that the distribution of *Aspidiotus destructor*, Sign., in the Punjab is increasing with the development of the fruit-growing industry; it is an important pest of grafted mangos, the damage adversely affecting the setting of the fruit and sometimes destroying young trees. As this Coccid is chiefly disseminated on nursery plants, it is suggested that the destruction of infested stock or its thorough treatment prior to transport should be made compulsory.

Ishwar Dayal Mathur (p. 234) gives the results of studies on the bionomics of *Melcha ornatipennis*, Cam., a parasite of the sugar-cane borer, *Scirpophaga nivella*, F., in the Punjab, Delhi, United Provinces and Bihar. This Ichneumonid breeds readily in the laboratory when provided with fully-fed host larvae that have made and covered their exit holes. Only one egg is laid on each host unless the latter are scarce, and if several are laid, only one parasite completes its development. Parthenogenetic eggs give rise to males. The egg, larval and pupal periods occupied 45 hours, 5–6 days and 10–11 days, respectively, but in winter the parasite larvae hibernate with their hosts, pupating early in the spring before those of *Scirpophaga* do so. The parasite larvae pupate in silken cocoons that vary in thickness according to the season. The adult parasites and the *Scirpophaga* larvae are both most active between August and October, and parasitism may then reach 35–40 per cent. At the beginning of the year, female parasites are generally more abundant than males, but in the autumn numbers are equal. The females live longer than the males.

E. J. Vevai (pp. 235–236) describes the beginning of an attempt to control *Pyrilla* by means of egg parasites at Karnal (Punjab), following a preliminary trial in 1938 [*R.A.E.*, A **32** 411]. The egg-masses were placed in wooden cages with sides of wire gauze (30–40 mesh per linear inch), which were distributed in the sugar-cane field at the rate of 21 per ½ acre. The collection of the egg-masses was started in July 1943, when *Pyrilla* appeared in the plots with the break of the monsoon.

M. C. Cherian and V. Margabandhu (p. 236) record that the Curculionid, *Amorphoidea arcuata*, Motsch., which is not as a rule a serious pest of cotton, was found breeding on the young bolls at Coimbatore in 1940. Early in February 1941, 35·2 per cent. of the young bolls that had been shed were infested, but the percentage had decreased to only 1·3 by the beginning of March.

M. C. Cherian and B. Rangiah Pillai (pp. 236–237) give notes on the bionomics of the Noctuid, *Selepa docilis*, Btlr., a minor pest of brinjal [*Solanum melongena*], and its Eulophid ectoparasite, *Euplectrus euplexiae*, Rohw., together with brief descriptions of the larvae and pupae of both and of the adult of the parasite. The egg, larval and pupal stages of *S. docilis* last 3, 7–10 and 7–11 days, respectively. The eggs are laid in groups of 4–12 on the shoots and upper surfaces of the leaves; the larvae feed, at first gregariously, on the upper surfaces, and

pupate in cocoons on the stem or leaf mid-ribs. The parasite eggs are deposited singly, generally one on each segment of the host larvae, which are usually attacked when 4–5 days old. The maximum number laid by a single female was 38, distributed on seven host larvae. The larvae hatch in less than 24 hours, feed for 3–4 days and then pupate on the ventral surface of the host. The adults emerge 4–5 days later.

M. C. Cherian and C. V. Sundaram (pp. 237–238) state that *Sesbania bispinosa* (*aculeata*) on a farm at Coimbatore was defoliated in November–December 1935 by larvae of the Noctuid, *Grammodes stolida*, F., all stages of which are described. Eggs are laid singly on the shoots and hatch in 2–4 days. The larvae feed for 15–22 days and pupate in silken cocoons constructed in folded leaves or occasionally in earthen cocoons in the soil. The pupal period usually lasts 10–12 days, but was prolonged in the three individuals to 101, 107 and 131 days. In the laboratory, the larvae fed on *S. grandiflora*.

T. V. Subrahmanyam (p. 238) reports that promising results were obtained in tests of the powdered rhizome of *Acorus calamus* as an insecticide against clothes moths, bed bugs and lice on fowls. Clothes moths confined with flannel dusted with the powder died in a few hours without ovipositing, whereas the control insects survived for several days and laid eggs from which the larvae that hatched fed on the flannel.

Dutt (G. R.), Patel (M. S.) & Sontakay (K. R.). **The Cotton Bollworms (*Earias fabia* Stoll, *Platyedra gossypiella* Saund., and *Heliothis obsoleta* Fabr.) in the Central Provinces and Berar.**—*Indian J. agric. Sci.* **13** pt. 1 pp. 1–17, 6 refs. Delhi, 1943.

Bollworms cause much damage to cotton in the Central Provinces and Berar, and an investigation was made in 1934–37 on their distribution, the extent of the injury they cause and the means by which they survive from one season to the next. Cotton is sown in late June or early July, the bolls open at the end of October or early in November, and harvesting continues until the end of December or, if the rainy season is prolonged, until the end of January. The plants are left in the field after harvest until February–March, and fresh shoots are present on them until this time; in some places in Berar, they are left until the end of April or May in wet years, and a second crop is gathered.

The investigation showed that *Earias fabia*, Stoll, and *Platyedra gossypiella*, Saund., are the most injurious species, and that *Heliothis armigera*, Hb. (*obsoleta*, F.) damages seedling cotton to some extent. *E. fabia* appears in July and causes very slight damage to the seedlings, but its progress is retarded by heavy rains in August and September. It increases rapidly when the bolls appear in October and remains active until the end of the season, when the damage due to it is heavy. *P. gossypiella* appears on the cotton in the latter half of September and increases at first gradually, but rapidly throughout December, until almost every boll is infested. *H. armigera* appears at the end of July in Berar, and is most abundant during September and until the middle of October, when it migrates to *Cajanus cajan* (*indicus*), a preferred food-plant commonly grown in or near cotton fields that begins to bear pods at that time. Larvae of *E. fabia* and *H. armigera* feed on the young shoots and foliage of cotton until the squares and bolls are produced.

The bionomics of *E. fabia* in this region resemble those in other parts of India [*R.A.E.*, A **24** 762]; it does not hibernate or aestivate. Most eggs are deposited between November and February, when each female generally lays over 300. The egg and pupal periods of *P. gossypiella* occupy 4–7 and 7–12 days, respectively. Both long- and short-cycle larvae occur, the larval stages lasting 20–41 days and 8–9 months, respectively. Short-cycle larvae are present on cotton plants until the end of April, after which green bolls are no longer

available. They were not observed during June and July at Nagpur, but there is some evidence for their presence during these months in Berar.

During the interval between the harvest and sowing, larvae of *E. fabia* were found until April on cotton plants left in the field and from March to August mainly on *Hibiscus esculentus* and perennial cotton [*Gossypium arboreum*]. They were not observed after June on cotton plants allowed to remain in the field during the summer. Larvae of *P. gossypiella* occurred mainly on *G. arboreum*; a few were found on *Althaea rosea* and *Hibiscus sabdariffa* and in cotton seed, but these do not constitute an important source of infestation. Long-cycle larvae occur to some extent in cotton stalks stored for fuel or thatching, but the activity of the adults to which they give rise in June–July is retarded by lack of mature food-plants. Larvae were also found in the soil in May, but the heavy rains of July–August are unfavourable for them and also for the adults present at that time. Some adults do develop from these larvae, however, as many larvae occur on self-set cotton and on *G. arboreum* in June–August. Unginned cotton gathered late in the season contains a fairly large number of larvae, but is not important as a source of infestation as most is sold before the summer. A few long-cycle larvae occur in stored seed; their development is greatly hindered by storing the seed in large heaps.

Preventive measures are the only ones available against these pests, and the early removal of cotton stalks after harvest, the destruction of self-sown cotton and of *G. arboreum*, the disposal of all seed cotton before May, and the prohibition of the cultivation of *H. esculentum* during summer are recommended.

Nazeer Ahmad Janjua, Mustafa (A. M.) & Samuel (C. K.). **On the Biology and Control of Codling Moth (*Cydia pomonella* Linn.) in Baluchistan.**—*Indian J. agric. Sci.* **13** pt. 2 pp. 113–128, 1 fig., 17 refs. Delhi, 1943.

Cydia pomonella, L., which was probably imported into northern India in fruit from Afghanistan [*cf.* *R.A.E.*, A **26** 340] is a very important pest in Baluchistan, where it has two generations a year and infests about 80 per cent. of the apples, pears and quinces in some areas [**27** 50]. Its six larval instars are described, and details are given of the results of investigations in 1936–40 on its seasonal history and control. Moths of the overwintered generation oviposited between mid-April and mid-May, and those of the summer generation between 24th June and 1st August. In addition to the more usual types of shelter, the larvae sometimes spun their cocoons in galleries made by the Cerambycid, *Aeolesthes sarta*, Solsky [*cf.* **30** 380] in apple stems. The only natural enemies observed were the Indian house sparrow (*Passer domesticus indicus*), which destroyed larvae in their winter cocoons, but is itself a pest of fruits, and the Encyrtid, *Paralitomastix varicornis*, Nees, which parasitised small numbers of the larvae.

In the experiments on control, which were made on two varieties of apple at Quetta, a calyx spray three days after the trees were in full bloom was followed by four cover sprays at successive intervals of 21, 10, 10–12 and 20 days. The quantities of materials given are per 100 gals. spray; the kerosene and crude-oil emulsions contained 80 per cent. actual oil. The approximate percentages of apples infested were 80 for no treatment, 25·7 for 4 lb. lead arsenate alone (except for a spreader), 16·4 for 4 lb. lead arsenate with 1 quart fish oil, 17–19 for 4 lb. lead arsenate with 1 gal. kerosene or crude oil emulsion, 24·8 for 4 lb. lead arsenate with ¾ pint nicotine sulphate, 27·5, 25·6 and 19·7 for 3 lb. calcium arsenate alone, with 1 quart fish oil and with ½ gal. kerosene emulsion, 24·3 and 19·3 for 4 lb. cryolite alone and with 1 quart fish oil and a little soap, 38·8 for 1 pint nicotine sulphate and 1 gal. kerosene emulsion, and 16·4 for cover sprays of the last mixture following a calyx spray of lead arsenate. Severe scorching was caused by the mixtures of lead arsenate and mineral oil and, late in the

season, by calcium arsenate with fish oil. Calcium arsenate was also tested with vegetable oils, but these sprays either scorched the foliage and affected the colour of the fruit or were less effective than calcium arsenate alone. None of the other sprays caused injury. Bait pans containing 1 part molasses, 9 parts water and enough yeast to start fermentation proved of value for timing the sprays.

Mohammad Afzal, Rajaraman (S.) & Manzoor Abbas. **Studies on the Cotton Jassid (*Empoasca devastans* Distant) in the Punjab. III. Effect of Jassid Infestation on the Development and Fibre Properties of the Cotton Plant.**—*Indian J. agric. Sci.* **13** pt. 2 pp. 192–203, 10 refs. Delhi, 1943.

A series of small-scale experiments, which are described in detail, were carried out at Lyallpur in 1938–40 to estimate the damage caused by *Empoasca devastans*, Dist. [*cf. R.A.E.*, A **29** 516] to the development and the fibre properties of resistant and susceptible varieties of cotton. Populations of 200–300 nymphs were maintained on plants grown from seed in Jassid-proof cages from mid-July to the end of October in each year. Tables show the weekly increase in height, flower and boll production, yield of seed cotton and the characteristics of fibre, including length, weight, maturity and warp count in infested and uninfested plants. Susceptible varieties suffered in every particular, and the reductions were significant in most cases, though those for mean fibre-weight per unit length and percentage of mature fibres were not. In resistant varieties there was little reduction in growth, flower and boll production or weight of seed cotton and no significant effect on the quality of the lint.

Hem Singh Pruthi. **A new important Pest of Wheat Crop in India.**—*Indian J. agric. Sci.* **13** pt. 2 pp. 232–234, 1 fig., 10 refs. Delhi, 1943.

Eurygaster maura, L., was found on wheat in the Zhob district of Baluchistan in 1926, 1937 and 1939, and caused severe damage there in 1940. It was again in evidence in 1941, when it was also taken on barley, and in 1942. It is evidently established, though only in a limited area, and the risk of its spread to other parts of northern India is pointed out. Data on its distribution, bionomics and control in other countries are reviewed.

Soyer (D.). **Miride du cottonier, *Creontiades pallidus* Ramb. Capsidae (Miridae).**—*Publ. Inst. Nat. Etude agron. Congo belge* Sér. Sci. no. 29, 15 pp., 6 pls. (3 col.), 10 refs. [Yangambi] 1942. Price *Fr.* 25. [Recd. 1944.]

Creontiades pallidus, Ramb., all stages of which are described, attacks cotton in Egypt [*R.A.E.*, A **11** 420; **13** 278] and the Sudan [**26** 513; **29** 386] and has been recorded from various parts of the Belgian Congo. It did not appear in any numbers at the Experiment Station at Gandajika until 1939, when investigations were begun on its bionomics, the damage it causes and its control. In the laboratory the females oviposited readily on cotton branches in water, chiefly in leaf scars and cut twigs; in the field, eggs were found in the tips of the bolls and in the grooves between the carpel walls; in very young bolls, 3–4 days of age, oviposition was observed to take place through the calyx at the base of the fruit. The eggs are deposited in groups of up to 20. There was little seasonal variation in the duration of the incubation period, which occupied 9–12 days in July–August and generally 8–10 in November–December [*cf.* **11** 421]. Development from egg to adult was completed in an average of 22 days. Nymphs reared on cotton in the laboratory did not survive after the first ecdysis, but nymphs in all instars were collected from cotton in the field. In December, when cotton is not available, *C. pallidus* occurs abundantly on maize, and a preliminary attempt to rear the nymphs on staminate inflorescences

having been successful, these were used for all other rearings, cotton being used for oviposition. Fourth-instar larvae reared on the maize inflorescences readily completed their development on young cotton bolls.

Tissues containing eggs rapidly become brown and pitted, and when several are present in a carpel groove, the pits may form a long furrow, which dries up and exposes the underlying fibres to the air and to pathogenic organisms or insects. If eggs are deposited in the main stem of a young plant, the part above them wilts and dies before they hatch. The injury caused by *C. pallidus* in the laboratory to various parts of the plant is described ; in the field, the branches, petioles and leaves are rarely attacked, and the insects are found among the bracts of the squares and of the bolls in approximately equal numbers. Young squares attacked by them turn brown and fall ; they are characterised by the presence of yellowish-brown excrement. The nymphs are found among the mass of young leaves and buds at the growing point, which they puncture, causing development to cease, and after successive moults, they attack the more fully-developed buds and the young capsules. Nymphs of all instars are more injurious than the adults. In the young bolls, the punctures are marked by small black spots, or if a glandular cell is pierced, by resinous droplets. Bolls attacked when they are not more than ten days old either fall or remain on the branch and become mummified. The insects were sometimes observed puncturing the peduncle, as a result of which the boll fell, but there was then no excrement on it. It was shown experimentally that, in addition to puncturing the older bolls, *C. pallidus* can transmit to them the spores of fungi causing boll-rots. As this Capsid is generally associated with *Lygus simonyi*, Reut. (*vosseleri*, Popp.), *Megacoelum apicale*, Reut., and *M. variabile*, Popp., on cotton, it is difficult to estimate its importance. The percentage shedding due to all species of Capsids was 6·1 in 1936 and 28·9 in 1939, when Capsids appeared much earlier and *C. pallidus* was abundant.

In experiments on control, dusts of pyrethrum and of colloidal sulphur applied in February and March to January-sown cotton were of no value, and reliance must therefore be placed on the use of resistant varieties of cotton and careful selection of sowing dates.

In addition to cotton and maize, *C. pallidus* was found on six other food-plants, including ground-nuts (*Arachis hypogaea*) and *Crotalaria juncea*. It occurred throughout the year in appreciable numbers only on a species of *Cynodon* and on maize, which, however, did not appear to be injured by it. No parasites were reared from it, and the only predator observed was *Geocoris amabilis*, Stål, which attacked the nymphs.

Rapport pour les exercices 1940 & 1941.—152 pp. Leopoldville, Inst. nat. Etude agron. Congo belge, 1943.

The section of this report entitled Division de Phytopathologie (pp. 20–32) contains summaries of work on pests and diseases of crops in the Belgian Congo during 1940–41. *Platyedra gossypiella*, Saund., was injurious to cotton in several districts in the vicinity of the Bambesa Experiment Station in 1941. The Braconid parasite, *Chelonus* (*Chelonella*) *ritchiei*, Wlkn., introduced against it was recovered from one site. *Tribolium castaneum*, Hbst. (*ferrugineum*, F.) injured stored cotton-seed oil-cake, and the use of light traps was recommended against it. Lime-sulphur sprays or sulphur dusts are recommended against *Tarsonemus* (*Hemitarsonemus*) *latus*, Banks, on rubber ; this mite also attacks cotton. *Theraptus* (*Pendulinus*) *devastans*, Dist., is of great importance in rubber plantations in the northern region, but has not been reported elsewhere. A rapid survey showed that *Asterolecanium coffeae*, Newst., had considerably extended its range on coffee in Ituri since 1939. *Sahlbergella singularis*, Hagl., was injurious on *Citrus*, and the Central American Tineid, *Semophylax apicipuncta*, Busck, was found at Bambesa on fruits of kapok (*Ceiba thonningii*).

Work at the Mulungu Regional Station included investigations on coffee pests, chiefly *Antestia*, which are briefly reviewed [*cf. R.A.E.*, A **31** 519–521]. Studies were also made on the bionomics of *Helopeltis orophila*, Ghesquière, on *Cinchona*. The life-cycle was found to occupy 42 days ; development is hindered by rain, and this Capsid is therefore most injurious during the dry season. The flower buds and the capsules are attacked to an equal extent. Of the various food-plants, only castor (*Ricinus communis*) is preferred to *C. calisaya* var. *ledgeriana*. This Capsid is parasitised by *Sarcophaga misera*, Wlk., another species of *Sarcophaga* and *Euphorus miridicidus*, Ghesquière, which is itself parasitised by *Stictopisthus hendrickxi*, Ghesquière. In experiments on control, pyrethrum dusts gave the best results, the average control during the dry season being 87·55 per cent. *C. succirubra* is the preferred food-plant of *Deilephila* (*Celerio*) *nerii*, L., against which a dust of pyrethrum in wood ashes is recommended. *Prodenia litura*, F., *Porthesia aethiopica*, Snell. (*natalensis*, Janse) and *Tigrioides quadrinotata*, Wlk., were observed on tea.

In experiments at Gandajika, the number of punctures per boll by *Dysdercus fasciatus*, Sign., was smallest on a variety of cotton that had bolls with rough outside walls covered with resin glands and greatest on the one that had bolls with the thinnest walls. The incidence of boll-rots appeared to be directly correlated with the number of punctures. Serious damage by the rosette disease [*Marmor arachidis* of Holmes] of ground-nuts (*Arachis hypogaea*) was prevented at the Experiment Station by favourable spacing of the plants and the use of crop rotation [*cf.* **32** 257–258]. Records of the rates of infection on six varieties over a period of four years gave no indication of any differences in resistance, and healthy plants of these varieties all became infected when colonies of *Aphis laburni*, Kalt., from diseased plants were transferred to them. Other insects recorded during the year included *Ootheca mutabilis*, Sahlb., on *Canavalia ensiformis*, *Aspidoproctus ghesquierei*, Vayss., on *Cassia siamea*, *Ptyelus grossus*, F., on castor, and a Dynastid, probably a species of *Heteronychus*, on maize.

Fraenkel (G.) & Blewett (M.). **The Utilisation of metabolic Water in Insects.**—*Bull. ent. Res.* **35** pt. 2 pp. 127–139, 21 refs. London, 1944.

Details are given of the results of experiments with larvae of *Tribolium confusum*, Duv., *Ephestia kuehniella*, Zell., and *Dermestes maculatus*, Deg. (*vulpinus*, F.), carried out to discover whether insects that live on flour or other dry food obtain the water necessary for their development from the products of metabolism, since earlier studies had shown that such insects grow faster at high than at low humidities. First-instar larvae were placed in suitable media and kept at various humidities until they pupated, when the dry weight of food consumed by each and the dry weight of the individual pupae were measured. The results are given in tables and discussed with reference to work by other investigators. At the lower humidities, more food was eaten to produce a given unit of body weight, the larval period was increased and the weight of the pupae decreased. The average water contents of pupae of *T. confusum* were the same at relative humidities of 70 and 20 per cent., and those of pupae of *E. kuehniella* were 67·8, 66·1 and 63·8 at relative humidities of 70, 20 and 1 per cent., the differences being significant. The average water contents of pupae of *D. maculatus* were 58·4, 59·2 and 60·3 at 70, 50 and 30 per cent. relative humidity, but then differences were not significant. Reasons for regarding the relation between the weight of food consumed and the increase in weight during development as a function of humidity and not of the length of the larval period or the size of the pupa are discussed. The water ingested with the food represented only 32·9 per cent. of the water content of the pupae of *D. maculatus* reared at 30 per cent. relative humidity and 7·6 per cent. of that of pupae of *E.*

kuehniella at 1 per cent. relative humidity. It is concluded that more food is consumed at low humidities because part of it is utilised as water, and the additional weight of food is estimated to be sufficient to produce the additional quantity of water required.

BRYANT (G. E.). **Two injurious Species of Phytophaga (Halticinae) from the Ivory Coast.**—*Bull. ent. Res.* **35** pt. 2 pp. 141–142, 2 figs. London, 1944.

The new species described are *Poëphila flaveola* on *Oncoba echinata* and *Jamesonia theobromae* on cacao, both in the Ivory Coast. *P. flaveola* is also recorded from the Gold Coast.

WRIGHT (D. W.). **Mercury as a Control for Stored Grain Pests.**—*Bull. ent. Res.* **35** pt. 2 pp. 143–160, 1 fig., 4 refs. London, 1944.

Metallic mercury has long been used in India to protect stored grain from insect pests, and experiments by various workers have shown that the vapour acts mainly, or exclusively, on the eggs of the insects [*cf.* *R.A.E.*, A **9** 79; **11** 79; **18** 30; **31** 352]. In small-scale experiments by the author, mercury prevented breeding by *Calandra granaria*, L., *Oryzaephilus surinamensis*, L., *Rhizopertha dominica*, F., and *Sitotroga cerealella*, Ol., when used at rates of 25, 100, 50 and 50 mg., respectively, per 100 cc. (2·8 oz.) wheat, these being the lowest rates tested except in the case of *Sitotroga*. Its effectiveness was confirmed in another experiment with *C. granaria*, in which it was applied at rates of from 66 to 150 mg. per 100 cc. wheat in galvanised iron bins with a capacity of about $1\frac{3}{4}$ bushels and about half full of grain; at the end of this experiment, injury due to insect infestation was less than 1 per cent., whereas in untreated bins it exceeded 25 per cent. Amalgams of mercury with zinc or tin and mercurous chloride (calomel) were also effective, though less so than metallic mercury, but zinc and mercuric chloride (corrosive sublimate) were not. All the effective materials were found to emit a vapour containing free mercury, which tarnishes gold leaf. When gold leaf was enclosed with metallic mercury, zinc amalgam and mercurous chloride, it was tarnished most quickly by the vapour given off by the mercury and least by that from the calomel, corresponding with the order of their effectiveness. The addition of other metals to mercury lowers its effectiveness by decreasing its vapour pressure, and the ineffectiveness of mercuric chloride appears to be correlated with the emission of an undissociated vapour. Adults of *C. granaria* kept in grain containing mercury mated and oviposited normally and their viability and ability to reproduce when transferred to a normal environment were not adversely affected, but the eggs of this species and those of *S. cerealella* shrivelled and failed to hatch when exposed to the vapour.

The effectiveness of a given weight of mercury increased when it was used in a finely-divided form, which provided a greater surface from which vaporisation could take place. When this condition was fulfilled by incorporating 27 per cent. mercury into a porous base, the rate at which the mercury could be successfully used was reduced from 66 mg. per 100 cc., corresponding to 186·5 lb. per 100 tons grain, to 5·4 mg. per 100 cc., corresponding to 15·2 lb. per 100 tons. The rate at which a given concentration of mercury vapour is reached is further increased by placing the mercury at different levels within the container to facilitate diffusion. It is suggested that grain in bulk could be protected by fixing "bricks" made of the mixture of mercury and the porous material to the walls of the store-chamber and keeping them from contact with the grain by meshwork containers.

Grain that had been stored with mercury for eleven months germinated normally and spectographic tests of grain stored with the metal for seven

months gave no indication of the presence of any deposit of it. Adults of *C. granaria* were able to breed normally in such grain.

Roy (D. N.) & Ghosh (S. M.). **The Mechanism of Action of a contact Insecticide.** —*Bull. ent. Res.* **35** pt. 2 pp. 161–170, 3 figs., 11 refs. London, 1944.

The experiments described, which are noticed in more detail elsewhere [*R.A.E.*, B **32** 226], indicate that a contact insecticide such as pyrethrum, either in liquid or powder form, normally enters the body of the insect through the spiracles and then diffuses through the tracheal walls, and that it does not penetrate rapidly into the body through the cuticle [*cf.* A **24** 587; **30** 47, 512; **31** 69, etc.].

China (W. E.). **New and little known West African Miridae (Capsidae) (Hemiptera Heteroptera).**—*Bull. ent. Res.* **35** pt. 2 pp. 171–191, 14 figs. London, 1944.

All but three of the Capsids dealt with belong to the subfamily Bryocorinae; its African and Mascarene genera are reviewed, four new ones being erected, and a key to them is given. The new species of this subfamily comprise *Prodromus thaliae* on *Thalia geniculata*, *Chamus boxi* on *Combretum racemosum*, *Poppiusia* (gen. n.) *combretorum* on *Combretum* sp., and *Idioaspis* (gen. n.) *macarangae* on *Macaranga horaefolia*, all in the Gold Coast [*cf. R.A.E.*, A **32** 288] and *Stenopterocoris* (gen. n.) *laticeps* on Nigerian oil palm [*Elaeis guineënsis*] and ground-nut [*Arachis hypogaea*] in Sierra Leone. *Lycidocoris thoracicus*, Dist., and *L. modestus*, Dist., are transferred to *Pantilioforma*; and *Distantiella*, gen. n., is erected for *Sahlbergella theobroma*, Dist. (the type) and *S. collarti*, Schout. Examination of the type of *Eucerocoris westwoodi*, White, has shown that it belongs to the genus *Helopeltis* and that *H. alluaudi*, Reut., is a synonym of it.

Rahman (K. A.) & Abdul Latif (M.). **Description, Bionomics and Control of the Giant Mealybug, *Drosicha stebbingi*, Green (Homoptera : Coccidae).**—*Bull. ent. Res.* **35** pt. 2 pp. 197–209, 1 pl., 3 figs., 22 refs. London, 1944.

Studies were made in the Punjab in 1938-42 on the bionomics [*cf. R.A.E.*, A **28** 466] and control of *Drosicha stebbingi*, Green, a pest of mangos in northern and central India, all stages of which are described. A list of 62 food-plants is given, including 23 not previously recorded; in addition to mango, it is most injurious on *Citrus*, *Zizyphus jujuba* and guava. The ovisacs occur in the soil, generally at a depth of 2–6 ins., but were occasionally found as deep as 2 ft. or on the surface of the soil. The maximum number of eggs laid by a female was 372 in the laboratory and 336 in the field [*cf. loc. cit.*]. The females pass through three nymphal instars in 77–135 days, and the males through four (including the pupal stage) in 76–134 days. Trees are preferred to low growing vegetation by the nymphs. Adult females lived for 22-47 days during April May in 1940 and 1941, but the males did not survive for more than a week. Mating takes place, soon after emergence, from the second week of April to the first week of May, and the females oviposit after 15-36 days; at 25°C. (77°F., 98·5 per cent. of the females oviposited, and at 30-33°C. (86-91·4°F.) only 74 per cent. did so. A list is given of three ants and 11 other insects that fed on the honey-dew produced by this mealybug. The natural enemies observed comprised five species of Coccinellids and larvae of *Chrysopa scelestes*, Banks, which destroyed the nymphs, a bird that fed on nymphs and adult females, an Ichneumonid of the genus *Phygadeuon*, which oviposited in second- and third-instar nymphs but was not reared, and a Dipterous parasite that was fairly common in March and May, and of which 39 adults were obtained from 371 nymphs and pupae of the mealybug collected on 25th March. The eggs of this

fly are deposited singly in the abdomen and thorax; they hatch in 4–9 days, and the larval and pupal stages occupy 15–27 and 6–14 days, respectively.

Destruction of the eggs by digging them from the soil did not offer promise for control because many of the females wander far from the infested trees before ovipositing. Various banding materials previously recommended to prevent the upward movement of the nymphs and the downward movement of the females [**8** 109; **13** 607; **16** 358; **28** 466] were tested on a field scale, but none was satisfactory. Bands of black oil cloth, 2–2½ ins. wide, prevented most of the second- and third-instar nymphs from ascending the trees, but were less effective against nymphs in the first instar. An adhesive banding material was prepared by stirring 1 lb. castor oil with ½ lb. concentrated commercial sulphuric acid, keeping this mixture for 14 days and then mixing it with a solution of 2½–3 lb. resin in 2 lb. axle grease to which 2 oz. commercial glycerine is added. This material applied to mango trees in December–March remained effective for 51–78 days in shade and 42–58 days when partly exposed to sun, and no nymphs succeeded in crossing it. Two applications, at the rate of 1 lb. for 10–20 trees for the first and 15–20 trees for the second, were necessary, and one or two additional coatings were required on stems that were directly exposed to the sun.

Cook (W. C.). **Studies of the Vitality of the Beet Leafhopper during the Fall and Winter in California as related to the Fat Content of the Insects.**—*Ecology* **25** no. 3 pp. 327–340, 5 graphs, 7 refs. Lancaster, Pa., 1944.

The following is based on the author's introduction and summary. In the San Joaquin Valley of California, the adults of the last of the summer broods of *Eutettix tenellus*, Baker, the females of which survive the winter and oviposit in spring, mature in October. They leave the rapidly drying summer food-plants and migrate to the desert plains and foot-hills towards the west and south. There they have to remain for a month or more on perennial shrubs, of which the most abundant is *Atriplex polycarpa*, as there is practically no other green vegetation, and by December most of the males and some of the females have died. Even after the rains have caused the winter annuals to germinate, the females that find them must survive a period of 1–2 months during which inclement weather permits feeding only at intervals. Unfavourable weather is followed by detectable mortality in some seasons and appears to weaken the leafhoppers in others.

To measure the resistance of females of the overwintering generation to such conditions, the number of days they could live without food at 20°C. [68°F.] with water supplied was used as a test of vitality. Vitality was high in early autumn, but gradually declined until winter. With leafhoppers that had been fed on sugar-beet, an equilibrium was reached during January, while with those taken from *A. polycarpa* no equilibrium was reached and vitality declined until the death of all the insects. The ether-extractives content of the leafhoppers followed a similar course, and the correlation between ether-extractives content and length of life was very high. The regression indicated that the amount of ether extractives lost for each day of starvation at 68°F. was about 0·0168 mg. Laboratory experiments during three autumn and winter seasons and field collections during the same periods agreed closely, both as regards duration of life and ether extractives.

White (W. H.) & Doolittle (S. P.). **A Victory Gardener's Handbook on Insects and Diseases.**—*Misc. Publ. U.S. Dep. Agric.* no. 525, 30 pp., 71 figs. Washington, D.C., 1944.

This paper contains a list of the common names of pests and diseases of vegetables and strawberries in the United States, arranged according to the

plants they attack, with notes on their appearance and distribution, the injury they cause and methods of controlling them, followed by notes on general methods of control, formulae for preparing the insecticides and fungicides recommended and information on spraying and dusting equipment and the quantities of material that should be applied.

HARRISON (P. K.) & ALLEN (N.). **Biology and Control of the Turnip Aphid.**—*Bull. La agric. Exp. Sta.* no. 365, 38 pp., 14 figs., 11 refs. [Baton Rouge, La.] 1943.

Rhopalosiphum pseudobrassicae, Davis, is the chief insect pest of turnips, mustard and radishes in the southern United States, and nicotine sprays and dusts have given widely differing results against it in different localities and under different conditions in the same localities. Studies on its bionomics and control were therefore made in Louisiana in 1932–38 in an attempt to develop a more satisfactory measure. The results of these investigations, the main features of which have already been noticed [*R.A.E.*, A **27** 371 ; **29** 596] are given in this bulletin, which also includes descriptions of the alate and apterous viviparous females, and characters distinguishing them from *Brevicoryne brassicae*, L., and *Myzus persicae*, Sulz., with which they are often associated, a map showing the distribution of *R. pseudobrassicae* in the United States, a list of 21 food-plants and another of natural enemies.

In the studies on the bionomics [*cf.* **29** 596], the development period was found to occupy four days in summer and 21 in winter. The adults produced up to 123 progeny over a period extending up to 43 days. Young plants appeared to be the most suitable as food, and the largest numbers of alates were produced on stunted, weakened or old plants, regardless of the number of individuals present. In May and September, however, alates were produced on young and succulent plants, and P. W. Mason suggests that this indicates that the Aphid formerly migrated between primary and secondary food-plants, of which only the latter is now utilised. Wingless oviparous females identified by him as *R. pseudobrassicae* were found with viviparous alates and apterae of the same species on mustard in North Carolina on 23rd December 1932.

In laboratory tests of insecticides, a spray of 5 lb. pine-tar soap in 100 U.S. gals. water gave a mortality of about 90 per cent. when humidity was high and temperature low, but the addition of 0·1 per cent. nicotine sulphate was needed to give satisfactory mortality under conditions of low humidity and high temperature. In trials in experimental plots, however, dusts, of which the most promising were a nicotine-sulphate mixture containing 3 per cent. nicotine and a derris mixture containing 1 per cent. rotenone [**27** 371], were found to be in general more satisfactory than sprays. These results were confirmed in field trials, which also indicated that the yield and quality of crops treated with the derris mixture were the higher. It appeared to increase the vigour of the plants, whereas three or more applications of the nicotine-sulphate dust caused the plants to become stunted. The derris dust remains effective for about a week ; it is more toxic to Coccinellids, which are important predators of *R. pseudobrassicae*, than the nicotine dust. Cultural measures of value in control [**29** 597] include crop rotation, where this is practicable.

JEWETT (H. H.). **Control of Green June Beetle Larvae** *Cotinis nitida* **(L.), in Tobacco Beds.**—*Bull. Ky agric. Exp. Sta.* no. 445, 10 pp., 2 figs., 9 refs. Lexington, Ky., 1943.

Adults of *Cotinis nitida*, L., oviposit in rich soil in summer, and the eggs hatch in 2–3 weeks. The larvae, which feed on humus and decaying vegetable matter, tunnel through the soil and to the surface, where they make mounds of earth round their exit holes. Many of them leave their burrows at night

during warm weather or when the soil is saturated. They hibernate at some depth in the soil, resume activity in spring and pupate about June. The pupal stage lasts 16–18 days. The overwintered larvae are injurious in tobacco plant beds in Kentucky [*cf.* also *R.A.E.*, A **14** 486] sometimes because they cover the plants with soil and sometimes because they make the soil so loose that the plants cannot establish themselves. When the seedlings are germinating or very small, 3–4 larvae per sq. ft. may kill all of them in dry weather, and badly infested soil contains 15–20 larvae per sq. ft.

Experiments on control were carried out in Kentucky in 1937–42. Emulsions or solutions containing kerosene, carbon bisulphide, ethylene dichloride, orthodichlorbenzene, dichlorethyl ether, or sodium cyanide, which are known to be effective against the larvae, caused very severe injury to young tobacco plants. Lead arsenate mixed with the surface soil at the rate of 10 lb. per 1,000 killed about 70 per cent. of the seeds sown after it was applied. When it was applied at the same rate by sprinkling a suspension in water when the plants were small, it did not injure them, but gave only 34 per cent. control of larvae. Of several poison baits tested, the most effective consisted of 26½ lb. dried apple refuse with 3½ lb. sodium fluosilicate, or 25 lb. moistened wheat-bran or maize-meal with 1 lb. Paris green, which killed about 70 per cent. of the larvae, while the survivors did little further damage. Baits should be applied to damp soil when the larvae begin to work, mainly near the openings of their burrows.

It was observed that in warm weather 80 per cent. of larvae appear on the surface of the soil, where they could be collected. The author suggests, however, that land in which tobacco is to be sown should be inspected in the previous autumn and should not be used if infested by *C. nitida*.

Entomology and Limnology.—*55th Rep. Cornell agric. Exp. Sta. 1942* pp. 121–132. Ithaca, N.Y., 1943.

W. A. Rawlins gives the results of work on *Limonius* (*Pheletes*) *agonus*, Say, in New York State. The adults appear in late April and early May, and the eggs are most frequently laid in cultivated soil, at depths of 2–9 ins. In preliminary trials, late tillage when oviposition was completed appeared to reduce populations considerably; fallow culture and late planting are also recommended [*cf.* *R.A.E.*, A **28** 469; **30** 361; **31** 6], but the latter is stated to be generally impracticable. Populations were relatively high in sweet clover [*Melilotus*], oats, potatoes and field beans and low in a mixed stand of clover and timothy grass [*Phleum pratense*], lucerne, wheat and maize, the differences being significant.

Rawlins and T. C. Watkins state that both calcium arsenate and ground cubé root were slightly more effective against the Colorado potato beetle [*Leptinotarsa decemlineata*, Say] when applied with a neutral copper spray than with Bordeaux mixture. Sprays of nicotine sulphate and commercial rotenone extracts were more reliable than ground cubé root against the potato Aphid [*Macrosiphum solanifolii*, Ashm.], but frequent applications are necessary. Fungicidal sprays containing Bordeaux mixture or neutral copper can be supplemented by dusts of rotenone and pyrethrum to control the potato leafhopper [*Empoasca fabae*, Harr.] and fleabeetles [*Epitrix cucumeris*, Harr.]; the addition to neutral copper sprays of bancroft clay, which is repellent, gave good results against these insects. Rawlins states that experiments started in 1936 on the effect of crop rotation on damage to potatoes by the wheat wireworm [*Agriotes mancus*, Say] confirm earlier results [**22** 391]. The tubers produced when potatoes followed a mixed stand of *Phleum pratense* and clover in a five-year rotation were usually severely injured; least damage occurred in a rotation of one or two years. Bordeaux mixture gave increased control of *E. cucumeris* and progressively increased yields of tubers as the amount of lime in it

was increased up to 16 lb. per 100 U.S. gals. Sprays and dusts applied against the overwintered adults did not cause a significant increase in yield, although considerable feeding takes place when the plants are small.

Watkins found that a spray containing 2 lb. tartar emetic and 4 lb. sugar in 100 U.S. gals. water was most effective in controlling the onion thrips [*Thrips tabaci*, Lind.] and increasing yield when treatment was started in June ; when it was delayed until after the first week in July, the increase in yield was less than 30 bushels per acre. Spraying should cease well before there is any risk of injury to the foliage in the process of application. Significant control was given by sprays applied at intervals of 3–10 days ; the best results followed the most frequent applications, and the most practicable interval appeared to be 5–7 days.

In experiments to determine whether reducing the size of the spray droplets would permit the use of a smaller dosage, there was no significant difference in yield from plants treated with various sprays containing tartar emetic, rotenone and nicotine atomised at a rate of 15–20 U.S. gals. per acre, and the greatest reduction in infestation did not reach 50 per cent. ; fine sprays must therefore either be applied at the same rate as normal ones or contain more insecticide per unit volume. Nymphal populations of *T. tabaci* reached peaks on onions about 20th June and 11th July in 1941, and adult populations on 2nd and 21st July ; numbers were not affected by rainfall. The amount of injury to carrots by first-generation larvae of the carrot rust-fly [*Psila rosae*, F.] was not affected by planting and harvesting dates, but that due to the second-generation larvae increased rapidly with delayed harvesting. First-generation damage was not reduced by applying rotenone dust or emulsions of dichlorethyl ether to the rows of carrots, probably owing to the lightness of the infestation, and treating the seed with calomel [mercurous chloride] resulted in stunted plants and decreased yields. Crude chipped naphthalene reduced infestation from 17 to 0·16 and 1·8 per cent. when broadcast five times at rates of 400 and 200 lb. per acre, respectively. The growth of young celery plants moderately injured by *P. rosae* improved after being treated with dichlorethyl ether emulsion, but at harvest time there was no noticeable difference between treated and untreated plants. In a field test of insecticides against the squash bug [*Anasa tristis*, Deg.], sprays and dusts containing pyrethrum were the most satisfactory against the nymphs and adults, but the treatments produced no noticeable effect on the yields since populations, which had increased rapidly in June and early July, decreased suddenly in mid-July.

H. H. Schwardt, C. G. Lincoln and T. W. Kerr, jr., report that infestation by larvae of June beetles [*Lachnosterna* spp.] was very severe in several areas in 1941 [*cf.* **32** 5]. Spores of the bacteria that cause milky disease of the Japanese beetle [*Popillia japonica*, Newm.] were distributed, dry or suspended in water, on experimental plots containing second-year larvae of *Lachnosterna*, but mortality was not significantly higher than in the control plots. The disease apparently occurs naturally in *Lachnosterna*, as infected larvae were found in the control plots and in areas well separated from the experimental area.

Schwardt states that in investigations to determine the correct timing for dusts against the Mexican bean beetle [*Epilachna varivestis*, Muls.], which should be applied to field beans after all the first-generation larvae have hatched, but before any have pupated, the mean period between planting and the first pupation was found to be 49 days, with a mean deviation of 3·97 days, in trials extending over three seasons in which planting dates ranged from 22nd May to 25th June. The dust is best applied about 10–12 days before pupation, and applications within 33–48 days of planting have resulted in increased yields. A properly timed application of a dust containing 0·75 per cent. rotenone [**32** 5] made with suitable equipment at the rate of 30 lb. per acre gave significant and economic increases in yield.

Schwardt and W. D. Wylie state that the advantages of methyl bromide as a grain fumigant (high toxicity, effectiveness at low temperatures and high

penetrating powers) are offset to some extent by various disadvantages. The minimum dosages toxic to the rice and granary weevils [*Calandra oryzae*, L., and *C. granaria*, L.], against which this gas is very effective, are of no value against the confused flour beetle [*Tribolium confusum*, Duv.], the saw-toothed grain beetle [*Oryzaephilus surinamensis*, L.] and other insects usually associated with the weevils. A dosage of 8 oz. per 1,000 cu. ft. kills insects in the grain within 2 ft. of the bottom of a bin, but is not effective against those at higher levels owing to the heaviness of the gas. A dosage as high as 3 lb. per 1,000 cu. ft. failed to give complete mortality, even in a very gas-tight bin, when there was a strong breeze. Methyl bromide at this rate and carbon bisulphide at 20 lb. per 1,000 cu. ft. both gave almost complete control in comparative tests, but the cost of the former was about half as much again as that of the latter.

Lincoln, L. D. Newsom and Schwardt state that following the favourable warm, dry season, newly-emerged adults of the clover root borer, *Hylastes* (*Hylastinus*) *obscurus*, Marsh., were abundant in September. There appears to be only one generation a year and no autumn flight. Paradichlorbenzene applied at the rate of 1,000 lb. per acre just before the spring flight greatly reduced the number of roots infested and also reduced the numbers of insects developing in the infested roots, which indicated that it acted both as a repellent and a fumigant. Naphthalene at the rate of 2,000 lb. per acre acted only as a repellent. Dichlorethyl ether gave promising results as a fumigant when the roots were already infested, but these treatments are all too expensive for general use. Variations in susceptibility to attack among different strains of red clover [*cf.* **32** 5] were masked by the heaviness of the infestation. In tests against the alfalfa snout beetle [*Otiorrhynchus ligustici*, L.], the pellet bait made from soy-bean meal sugar and sodium fluosilicate [**31** 15] was equal or superior to one prepared from raisins and shorts [**30** 387] under conditions of heavy infestation ; baits prepared from maize-cobs and ground-nut hulls are cheap and easy to prepare, and gave good control under most conditions, but were less effective at extremes of temperature and moisture. The weevils were found to require food before ovipositing ; those fed on mixtures of raisins and shorts or soy-bean meal and sugar laid considerable numbers of eggs, though fewer than those fed on lucerne. Infestation by the larvae was the lightest recorded, and injury was still further lessened by good growing conditions. Differences in the humidity of the soil did not affect the control obtained with an emulsion of dichlorethyl ether and methyl bromide [**32** 5], but an application of water after the emulsion was necessary to prevent the gas from dissipating into the air.

R. L. Patton states that work on the physiological effect of arsenic on insects indicates that the balance of water in the blood is significantly altered by it and that its action is associated with the metabolism of oxygen.

Zoology—Entomology.—*52nd Rep. Ala. agric. Exp. Sta. 1941* pp. 27–32. Auburn, Ala. [1942.] [Recd. 1944.]

L. L. English briefly reviews the results of work in Alabama on the control of pests of azaleas and camellias by fumigation [*cf. R.A.E.*, A **32** 202, 369], and by sprays and dusts. Derris increased the effectiveness of oil sprays against *Fiorinia theae*, Green, on camellias ; an oil spray containing nicotine sulphate was of greater value against *Heliothrips haemorrhoidalis*, Bch., on azalea than a spray containing tartar emetic and sugar or pyrethrum dusts ; and a proprietary dust containing dinitro-o-cyclohexylphenol controlled *Paratetranychus ilicis*, McG., but injured the plants in warm weather.

J. M. Robinson and E. L. Mayton give the results of experiments in 1924–41 in which the gain in yield of cotton due to the control of the boll weevil [*Anthonomus grandis*, Boh.] by dusting with calcium arsenate, in years in which the

amount of infestation required it, increased with the amount of fertiliser applied to the plots.

F. S. Arant states that a dust of derris, talc and flour with a rotenone content of 1 per cent. was not effective in 1941 against *Diaphania nitidalis*, Stoll, on cantaloupe melons when applied at intervals of 10–15 days during rainy weather; at intervals of 5 days, it gave 61 per cent. control, which is 22–33 per cent. lower than that obtained in previous years under more favourable weather conditions. Infestation was very heavy in late cantaloupe melons growing next to earlier melons, and derris and cubé dusts containing 1 per cent. rotenone gave little material control until the rate of application was increased to 20 lb. per acre. Twelve applications at an average rate of 17½ lb. per acre did not give economic control, although the yield per acre from treated plots was 750–2,080 uninfested fruits, whereas none was obtained from the controls. Derris was of greater value than cubé. On cucumbers, ten applications at intervals of five days of derris or cubé dusts containing 1 per cent. rotenone at 12½ lb. per acre gave 93 and 79 per cent. control, respectively.

The roots of toxic strains of *Tephrosia virginiana* grown in Alabama over a period of three years maintained their rotenone content, which averaged 1·76 per cent. and was not affected by the use of fertilisers. The powdered roots of locally-grown plants were effective against *Epilachna varivestis*, Muls., and *Murgantia histrionica*, Hahn, those with the highest rotenone-deguelin value being generally the most satisfactory. Commercial derris was more effective than cubé with the same rotenone content, but a rotenone-deguelin value 1·3 times less, against these two species and *Leptinotarsa decemlineata*, Say, *Chrysochus auratus*, F., and cabbage caterpillars, but the cubé appeared to be equally effective against nymphs of *Anasa tristis*, Deg. [*cf.* **31** 336].

KNOWLTON (G.). **Mormon Cricket Control in Utah.**—*Proc. Utah Acad. Sci.* **19–20** p. 89. Provo, Utah [1943].

Work against the Mormon cricket [*Anabrus simplex*, Hald.] in Utah in 1937–41 is briefly reviewed. The measures employed comprised the application, directly on to the insects, of a dust of sodium arsenite and hydrated lime (1 : 4) in early spring, and, in 1940–41, the use of a poisoned bait of 3 lb. sodium fluosilicate and 1 U.S. gal. oil in 100 lb. bran in the hottest parts of the summer. Metal barriers were effective in stopping migration and in trapping large numbers of the insects in a few areas. In 1940, a total of 186,250 acres of range and cultivated land, chiefly in the north-west, was infested. As a result of intensive campaigns in that year and 1941, the area under attack was reduced to 24,980 acres, of which only 250 acres were heavily infested. The change in distribution and intensity of infestation indicated that 85 per cent. of the population was destroyed during 1940–41.

CAGLE (L. R.). **Life History of the Spider Mite** *Tetranychus schoenei* **McG.**—*Tech. Bull. Virginia agric. Exp. Sta.* no. 87, 16 pp., 4 figs., 2 refs. Blacksburg, Va., 1943.

Tetranychus schoenei, McG. [*cf. R.A.E.*, A **30** 414] was first found in association with the European red mite [*Paratetranychus pilosus*, C. & F.] on apple in one orchard in Virginia in 1939, and the two mites were considered to be equally responsible for the severe injury caused, which consisted of bronzing of the leaves by August and failure of the fruit to colour. Similar injury occurred in the same orchard in 1940 and 1941, and *T. schoenei* is now known to be present in the principal apple sections of Virginia.

The larva, nymph, adult male and summer and hibernating females are briefly described. In insectary tests made in 1941 and 1942, six overlapping generations were reared on apple leaves between mid-June and

the end of the season, and it was estimated that these were the fourth–ninth generations of the year. Only adult females overwintered. The first hibernating females were reared from eggs deposited on 24th August 1941 and 28th July 1942, and belonged to the eighth and fifth generations, respectively; all females of the ninth generation were hibernating forms. They mated readily in the autumn, but no eggs were obtained until the following year, and both mated and unmated individuals survived the winter. The mites spun a considerable amount of webbing, in which the eggs were deposited. The incubation period varied from 3 days at an average temperature of 81·6°F. to 25 days at an average of 52·6°, the larval period from 1 day (76·8°) to 7 days (59·3°), the protonymphal period from 1 day (75·7 and 80·3°) to 11 days (55·3°) and the deutonymphal period from 1 day (77·8 and 78·3°) to 19 days (47·6°). The total developmental period was 5 days at 80·7° and 34 days at 51°. The preoviposition period lasted 1–5 days and the longest oviposition period 38 days; the maximum number of eggs per female was 106. All mites from unfertilised eggs were males, and over 80 per cent. of those from fertilised eggs were females.

WATSON (J. R.). **A tropical Book Worm in Florida.** *Neogastrallus librinocens* **Fisher, in Florida (Anobiidae, Col.).**—*Florida Ent.* **26** no. 4 pp. 61–63. Gainesville, Fla., 1943.

Records, obtained by the author or E. A. Back, are given of infestation of books by *Neogastrallus librinocens*, Fisher, in three libraries in Florida and one in Louisiana, observed since those already noticed [*R.A.E.*, A **28** 354]. Like the latter, they are all attributed to the introduction or subsequent distribution of infested books from Havana. Two of the Florida libraries were freed from infestation by fumigation with hydrocyanic acid gas [**28** 355].

WATSON (J. R.). *Melipotis acontioides* (Guen.) **in Florida.**—*Florida Ent.* **26** no. 4 p. 71. Gainesville, Fla., 1943.

Poinciana (*Delonix*) *regia* is not as a rule seriously attacked by insect pests in Florida, but in 1942 and 1943 it was defoliated by larvae of the Noctuid, *Lyncestis* (*Melipotis*) *acontioides*, Gn., the range of which coincided with that of the tree. The larvae, or at any rate the larger ones, sheltered by day in the soil or in shade on the food-plant and fed by night. They occurred throughout the year at Key West, and there are evidently several generations annually. Attempts to rear the larvae on leguminous plants other than *P. regia* were unsuccessful.

SCHAFFNER jr. (J. V.) & MCINTYRE (H. L.). **The Pine Root-collar Weevil.**—*J. For.* **42** no. 4 pp. 269–275, 2 figs., 22 refs. Washington, D.C., 1944.

Hylobius radicis, Buchanan, all stages of which are briefly described, is now known to occur in scattered localities from the New England States and New York south to Virginia and west into Minnesota. Its favoured food-plants are Scots, Austrian and Corsican pines [*Pinus sylvestris* and *P. nigra* vars. *austriaca* and *calabrica*], and it has become a serious pest of these trees, where they have been planted in pure or nearly pure stands, though heavy infestations have been observed only where they were on light, sandy soils. Attack on other species of *Pinus* has been observed, but no serious injury resulted unless they were close to heavily infested preferred food-plants. *H. radicis* is not a pest in areas of natural reproduction of native species. Trees of all ages may be successfully attacked, but the heaviest infestations and the most severe damage occur in those that are 5–20 years old. The principal injury is caused by the larvae, which live entirely in the cambial region of the root collar [*cf. R.A.E.*, A **25** 438]. Trees may be infested for several years without heavy mortality, but in

such cases they are badly stunted and have exceedingly large butts in proportion to their height. Eventually they are completely girdled and die, are broken by the wind, or succumb to attack by bark-beetles. The adult weevils feed on the bark of the lateral and terminal twigs, hiding at the base of the tree during daylight, and heavy infestations cause considerable damage.

Investigations in New York, Massachusetts and Connecticut showed that the eggs are laid singly, usually in pockets gnawed in the bark at the base of the tree by the female, but sometimes in the soil close to the tree, and hatch in 7–17 days. The oviposition period each year usually extends from the second half of May to the end of August, and newly hatched larvae are present from late May until September, though they are usually most abundant during the second half of June and in July. The larvae remain in the cambium for about a year, boring down a little deeper for hibernation, and resuming activity in spring. They pupate early in summer in cells of frass and pitch-infiltrated soil [*cf.* **25** 375] 1–2 ins. below the ground surface near the root collar or in enlarged larval tunnels in the bark of the root collar if the tree is dying. The adults usually emerge from late July to September and feed, but do not oviposit, before re-entering the soil to hibernate. They leave hibernation in April or May and may remain active until the middle of October, when some enter hibernation for the second time ; these may oviposit again during the next season. Females kept in cages throughout the oviposition period produced 40–64 eggs in one season, and one produced 10 during the next season.

Many chemicals have been tested against *H. radicis*, and a few have given promising results, but none has resulted in complete control. The cost usually makes direct control impracticable in large plantations, but in ornamental plantings and on recreational areas, the expense may be justified in order to save trees that are not too severely injured. An emulsion of ethylene dichloride (25 per cent.) was found effective against the larvae but not against the adults. The best results were obtained when dichlorethyl ether (5 per cent.) or dinitro-o-cyclohexylphenol (0·5 oz. per U.S. gal.) were added to it ; these mixtures gave 88·9 and 84·4 per cent. mortality of adults when applied in October 1941, and caused no injury to the trees. They should be applied directly round the base of the tree, which should be completely encircled, at the rate of ½ U.S. pint for trees 2–3 ins. in diameter at the base and 1 U.S. pint for those up to 6 ins., preferably between mid-May and late September and when the soil is fairly dry. It is unnecessary to remove the needle litter round the bases of the trees, but they should be cleared of branches to a height of 24–30 ins. to facilitate application.

Atwood (C. E.). **The Feeding Habits of young Spruce Budworm Larvae.**— *Canad. Ent.* **76** no. 3 pp. 64-66, 1 fig., 6 refs. Guelph, Ont., 1944.

Observations made in western Quebec and northern Ontario in 1941 and 1942 showed that young larvae of *Harmologa* (*Cacoecia*) *fumiferana*, Clem., which periodically appears in vast numbers on spruce [*Picea*] and balsam fir [*Abies balsamea*] in Canada and the northern United States, almost invariably formed mines in the old needles of both kinds of trees in spring before attacking the new buds. The behaviour of the larvae in forming the mines is described. Most of the mined needles fell off before mid-summer. It had previously been generally accepted that young larvae always make their first attack on the buds or young foliage. It is possible that the behaviour here recorded may have been caused by the exceptional earliness of spring in these two years. Mining would protect the young larvae from predators and bad weather until the buds of balsam fir had opened. The mines facilitate the estimation of the comparative size of infestations. It would seem that when mining occurs, a carefully applied spray or dust covering both the buds and needles would be likely to kill the larvae before they reached the protection of the new shoot.

Substitutes for scarce Materials.—*A[gricultural] W[ar] I[nformation] U.S. Dep. Agric.* no. 15, 16 pp. [Washington, D.C.] 1942. [Recd. 1944.]

This pamphlet deals with possible substitutes for some of the principal materials, now scarce in the United States owing to war conditions, normally used as insecticides against pests of plants, animals and man, or as fungicides, disinfectants, fertilisers, or medicines and supplementary foods for livestock. The difficulty of recommending substitutes for insecticides owing to their highly specific character is pointed out, as are also complications arising from the effect of climate on the reaction of a plant to an insecticide, poisonous residues, costs and the necessity for special kinds of equipment. The value of cultural methods as substitutes for insecticides is mentioned. A list of insecticidal materials is then given (pp. 6–16), showing the kinds of insects against which each may be used. Under each insect entry, reference is made to the preferred substance for its control if the main entry is to a less satisfactory one. Where the main entry is to the preferred substance, possible substitutes are shown in order of desirability.

DO VALLE REGO (C.). **Indicações sobre o combate químico às doenças e pragas da lavoura.** [Information on the chemical Control of agricultural Diseases and Pests.]—*Publ. Div. Def. sanit. veg. Minist. Agric. Brasil* no. 18, 144 pp., 24 pls. (3 col., 1 fldg.), 13 figs., refs. Rio de Janeiro, 1943.

In the introduction to this paper, the author discusses the control of insect pests and diseases of plants by biological, mechanical and chemical means and the consumption of insecticides and fungicides in the United States and Brazil in recent years. In the first part, he deals with fungicides and in the second with different types of insecticides used in Brazil. Formulae are given for the preparation of sprays, dusts and baits, and the uses and action of these insecticides and fumigants are described. Appendices contain recommendations for the control of pests of fruit and notes on the bionomics and control of leaf-cutting ants of the genus *Atta*.

14a Memoria de la Estación experimental agrícola de La Molina correspondiente al año 1941. [Report of the Agricultural Experiment Station at La Molina for the Year 1941.]—[6]+276 pp., illus. Lima, Minist. Fom. Peru [1942]. [Recd. 1944.]

This report includes a section by J. E. Wille (pp. 189–231) on insect pests in Peru in 1941. The most important parasite of *Mescinia peruella*, Schaus, which attacked cotton bolls as in previous years [*cf. R.A.E.*, A **31** 516, etc.], was identified as *Nemeritis* (*Idechthis*) *peruviana*, Cushm. Two unidentified species of *Platynota* were associated with *Mescinia* and caused similar injury to the bolls and terminal buds. *Heliothis virescens*, F., again caused serious damage to cotton in the Cañete valley ; it was present, but not injurious, in other coastal valleys. Infestation of ratoon cotton in the lower parts of the Huaura valley, which reached 50 per cent. in October and resulted in severe damage to the bolls, increased until December. In this month, the adults migrated to planted cotton, on which the first bolls were heavily infested. In February, the infestation began to decrease, owing partly to destruction of the eggs by *Orius* (*Triphleps*), but chiefly to climatic conditions and the fact that the plants were no longer so attractive, being older and in a less rapid state of growth. At the end of 1940 and the beginning of 1941, *Dysdercus ruficollis*, L., was extremely scarce on cotton in the valleys of Huaura, Supe and Pativilca, in which it is usually very injurious, because intense sunshine and lack of clouds retarded its development, though it was numerous on wild malvaceous plants in the upper parts of the valleys, where there was unusually heavy cloud

and little sunshine. It migrated in numbers to the lower valleys during February and March, by which time the first bolls were mature. These were uninjured, but those that were forming were considerably damaged. On higher ground and in late fields, the first and later bolls were both attacked, and no crop could be harvested. Parasitism was negligible. In winter, the Pyrrhocorid migrated to the hills, where it was very abundant on wild plants, and in September it began to return to the valleys, flying at night in large swarms that were attracted by lights. It was numerous in October, but diminished considerably during the next two months, owing to powerful sunshine, so that bolls harvested in December showed little damage. Both *D. ruficollis* and *Anthonomus vestitus*, Boh., were relatively unimportant in the lower parts of the Piura valley, owing chiefly to climatic conditions, but caused more damage in the upper parts and were very injurious in parts of the Chira valley, where a susceptible variety of cotton is grown and recommendations for a close season were not followed. As excessive foliage provides shade favourable to the insects, irrigation and fertilising should be carried out in moderation. In the Lima valley, parasitism of *Anomis texana*, Ril., by *Blondelia* (*Eucelatoria*) *australis*, Tns., was high throughout the year, and further north parasitism by a species of *Meteorus* was common. *Alabama argillacea*, Hb., was abundant in the Piura valley, but was controlled by up to eight applications of a spray of 0·5–1 per cent. calcium arsenate, which was preferred by the growers since the applications of arsenical dusts sometimes resulted in outbreaks of *Aphis gossypii*, Glov. In May, eggs were parasitised by *Trichogramma minutum*, Ril., eggs and young larvae were attacked by a Reduviid of the genus *Zelus* and an Anthocorid, and larvae and prepupae were parasitised by a Braconid (*Rogas*), Tachinids and Ichneumonids, with the result that spraying was no longer necessary. Other pests observed on cotton included *Tetranychus peruviensis*, McG., which was very injurious in spring in a few fields in the upper part of the Huaura valley, and a species of *Empoasca*, which was readily controlled with sulphur dust ; *Lasioderma serricorne*, F., was found in seeds from two localities.

Diatraea saccharalis, F., was more injurious than usual on sugar-cane in the Huaura valley, but was eventually controlled by *Trichogramma minutum* and *Ipobracon rimac*, Wolc. ; on sugar-cane and rice in the Chira valley, it was parasitised by these Hymenoptera and by *Theresia* (*Paratheresia*) *claripalpis*, Wulp. Rice was also attacked by *Blissus richardsoni*, Drake, and a species of *Pseudococcus* damaged the ears while they were still inside the leaves. Infestation of maize by *Laphygma frugiperda*, S. & A., was less severe than previously in the Lima area, as many as 80 per cent. of the larvae being parasitised by Tachinids and Ichneumonids of the genus *Pimpla*. The grains were severely infested by the Scolytid, *Pagiocerus frontalis*, F., in the field and in store. A heavy outbreak of Noctuids, principally *Heliothis armigera*, Hb. (*obsoleta*, F.), *L. frugiperda* and *Anticarsia gemmatalis*, Hb., and of a Pyralid destroyed maize, wheat and lucerne in Santa Ana (Province of Lucanas). They are seldom injurious there, but developed rapidly owing to unusually hot weather in February and March and lack of heavy rainfall.

Citrus was attacked in different localities by a species of *Anastrepha*, *Phyllocoptruta* (*Phyllocoptes*) *oleivorus*, Ashm., which damaged the rind, and *Diabrotica decolor*, Erichson, and a species of *Chalepus*, both of which fed on the leaves. *Toxoptera aurantii*, Boy., occurred on the new buds during winter, but was controlled by Coccinellids, including *Cycloneda* (*Neda*) *sanguinea*, L., Syrphids, species of *Chrysopa*, and a fungus. *Chrysomphalus dictyospermi*, Morg., and *Parlatoria pergandei*, Comst., were very injurious in one district, and *Lepidosaphes beckii*, Newm., and *Selenaspidus articulatus*, Morg., in others. The distribution of *Icerya purchasi*, Mask., had increased considerably. In one area it was found on orange and on *Spartium junceum*, *Ambrosia artemisifolia* and *Caesalpinia spinosa* (*tinctoria*), the predacious Coccinellid, *Rodolia* (*Novius*) *cardinalis*, Muls., being present on all the plants,

but in another, both insects occurred on the wild food-plants, but not on *Citrus*. The parasite, *Aphelinus mali*, Hald., introduced for the control of *Eriosoma* (*Schizoneura*) *lanigerum*, Hsm., on apple [*cf.* **31** 517] was found to be established. *Scolytus rugulosus*, Ratz., and *Dinoderus bifoveolatus*, Woll., were present in the trunks and branches of apple ; in the central coastal zone, infestation of the fruits by *Anastrepha*, probably *A. fraterculus*, Wied., was heavier than usual. This species was observed in flight over olive trees, but did not appear to attack the olives, possibly feeding on sugary secretions of the trees and the honey-dew of *Saissetia oleae*, Bern. Olive was infested by larvae of *Margaronia quadristigmalis*, Gn., which was more injurious than usual, attacking half ripe and ripe fruits in addition to new shoots and leaves, *Orthezia insignis*, Dgl., and *Selenaspidus articulatus*. Borers in grape-vine comprised *Micrapate scabrata*, Erichson, *Bostrychopsis eremita*, Erichson, *Xyleborus dispar*, F., and a Cossid of the genus *Givira* ; the Coccid, *Margarodes vitium*, Giard (*vitis*, auct.) was present on roots and branches in one district. Infestation by *Phylloxera vitifoliae*, Fitch (*vastatrix*, Planch.) was severe in the valley of Majes, where the vines are dying, and the valley has been put under quarantine. *Tortyra fulgens*, Feld., bored in the new shoots of fig in the coastal region. *Pseudaulacaspis* (*Aulacaspis*) *pentagona*, Targ., occurred on peach in all the valleys of the coastal and mountain regions, but was heavily parasitised by a species of *Prospaltella*. Avocado was attacked by *S. articulatus* and *Pulvinaria* (*Protopulvinaria*) *pyriformis*, Ckll., cherimoya [*Annona cherimolia*] by *Conchaspis angraeci*, Ckll., mango by *Coccus* (*Lecanium*) *hesperidum*, L., which is controlled by the larvae and adults of Coccinellids, particularly species of *Scymnus* and *Azya*, and plum by *Hemiberlesia* (*Aspidiotus*) *rapax*, Comst., and *Quadraspidiotus* (*A.*) *perniciosus*, Comst.

Coffee was infested by *Coccus hesperidum* and *Leucoptera coffeella*, Guér., cacao by *Monalonion* sp., *Parajalysus spinosus*, Dist., and *Apateticus* sp., and coca [*Erythroxylon coca*] by *C. hesperidum* (which was parasitised by a species of *Encyrtus*), species of *Pseudococcus* and *Kermes*, *Eloria noyesi*, Schaus, and *Eucleodora cocae*, Busck.

Pests of flax [*cf.* **31** 515] included the Noctuid, *Copitarsia turbata*, H.-S., in the stalks and flower buds, and *Agromyza* (*Liriomyza*) *flavcola*, Fall., and *A. virens*, Lw., on leaves and stalks, where they were parasitised by the Eulophids, *Solenotus websteri*, Crwf., and *Chrysocharis ainslici*, Crwf., and a Pteromalid of the genus *Heteroschema*. Hemp (*Hibiscus cannabinus*) was attacked by *Dysdercus ruficollis* and *Cryptocephalus picturatus*, Boh. (*topiarius*, Suffr.), potato by *Gnorimoschema plaesiosema*, Turner (*melanoplintha*, Meyr.) and the Aphids, *Myzus persicae*, Sulz., *Macrosiphum solanifolii*, Ashm., and *M. solani*, Kalt., which transmitted mosaic disease, tomato by *Rhagoletis ochraspis*, Wied., *Diabrotica venalis*, Erichson, *Laphygma* (*Xylomyges*) *eridania*, Cram., *L. frugiperda* and species of *Nezara* and *Leptoglossus*, melons by *Diaphania nitidalis*, Stoll, and *D. hyalinata*, L., and cabbage by *Ascia* (*Pieris*) *monuste*, L. Pests of leguminous crops [*cf.* **31** 477] included *Elasmopalpus lignosellus*, Zell., in the stalks and roots of French beans, *Epinotia opposita*, Heinr., on ground nuts [*Arachis hypogaea*] and clover, and *Anticarsia gemmatalis* on lucerne.

Principales plagas agrícolas producidas por insectos y otros animales que fueron objeto de consulta en el primer semestre (Enero-Junio) de 1943. [The principal Injuries to Crops caused by Insects and other Animals that were reported in Chile in the first Half of 1943.]—*Bol. Dep. Sanid. veg.* **3** no. 1 pp. 42–44. Santiago, Chile, 1943.

This further list [*cf. R.A.E.*, A **32** 294] includes records of injurious insects, with their food-plants and the localities in which they were observed.

Trabajos posteriores a la campaña de erradicación de la "mosca de la fruta," en los valles de Azapa, Codpa y Timar (Enero a Junio de 1943). [Work carried out since the Campaign to eradicate the Fruit-fly in the Valleys of Azapa, Codpa and Timar (January to June 1943).]—*Bol. Dep. Sanid. veg.* **3** no. 1 pp. 56–60. Santiago, Chile, 1943.

Inspection of fruit trees, bait-traps and picked fruit in the three valleys in January–June 1943, revealed no further infestation by *Anastrepha fraterculus*, Wied., since that reported from the Azapa valley in October 1942 [*R.A.E.*, A **32** 295].

Labor de la campaña contra el bruco del frejol (Enero a Junio de 1943). [Work in the Campaign against the Bean Bruchid (January to June 1943).]—*Bol. Dep. Sanid. veg.* **3** no. 1 pp. 61–64. Santiago, Chile, 1943.

During the first six months of 1943, infestations of *Bruchus* (*Acanthoscelides*) *obtectus*, Say, were found in stored French beans in the Provinces of Atacama and Aconcagua. The source of the infestations was not discovered, but is probably outside the Limache valley, and control measures [*cf. R.A.E.*, A **32** 295] were therefore extended.

Norris (D. O.). **Pea Mosaic on *Lupinus varius* L. and other Species in Western Australia.**—*Bull. Coun. sci. industr. Res. Aust.* no. 170, 27 pp., 2 pls., 1 fig., 22 refs. Melbourne, 1943.

Lupinus varius is an important fodder plant in the sandy soils of parts of Western Australia, as its seeds provide protein food for sheep during the hot dry summer. It is maintained by self-sown seed. A disease that destroyed this and other species of lupins on experimental plots was identified as the pea mosaic [*Marmor leguminosarum* of Holmes], and investigations on it were carried out near Perth in July–November 1941 and at Canberra in 1942. The symptoms in five species of *Lupinus* are described. The virus was transmitted to peas and similar plants by inoculation or grafting, except from *L. varius*, some substance in the sap of which apparently prevented infection. Seed transmission did not occur in lupins or subterranean clover (*Trifolium subterraneum*), but is suspected in peas. Nine species of Aphids collected near Perth were all capable of acquiring and transmitting the virus, but the majority died within 24 hours when forced to feed on *L. varius*; only *Myzus persicae*, Sulz., was able to survive more than a few days, and this species is considered to be the main vector in Western Australia. Although alates of *M. persicae* settled readily on *L. varius* and produced many young, very few of the latter seemed to mature on it; no secondary winged forms developed, so that the disease did not spread within the crop, except where plants overlapped. The winter is sufficiently mild to enable the Aphid to survive in the viviparous phase, but no large populations occur, probably owing to the short heavy falls of rain; survival during the dry summer must be by rare apterous individuals on perennial shrubs in gardens, on the few succulent plants maintained by irrigation, or in isolated moist situations.

Both virus and vectors are eliminated from the lupin crop each season by the dry summer, but the virus was found to survive on *Cassia corymbosa*, which is a garden perennial shrub. Field evidence suggested that it serves as a seasonal reservoir and source of infected Aphids in the same way as red clover (*T. pratense*) does in other countries [*cf. R.A.E.*, A **32** 138], though attempts to transmit the virus from it to peas and lupins by means of Aphids were unsuccessful. Reinfection of lupins occurs from peas, broad beans and sweet peas (*Lathyrus odoratus*), but many plants are not attacked until some pods are almost mature, and others form a few seeds in the secondary bunchy-top

phase of the disease, so that the re-establishment of the crop in the following year is ensured. The disease is therefore of little economic importance.

A decrease in susceptibility to infection with increase in alkaloid content observed in the species of *Lupinus* studied is considered to be due to the effect of the latter on their palatability to Aphid vectors.

SPILLER (D.). **The seasonal Cycle of the Hard-wax Scale in New Zealand.**—*N.Z.J. Sci. Tech.* **25**(A) no. 3 pp. 129–130, 2 refs. Wellington, N.Z., 1944.

Cottier found that *Ceroplastes sinensis*, Del G., has one generation a year on *Citrus* in New Zealand and reproduces in January–March [*R.A.E.*, A **28** 49]. As a detailed knowledge of the life-history is desirable for the application of control measures, the reproductive phase was studied in 1939, 1940 and 1941. Material was obtained from December to May from heavily infested trees of *Vitex lucens* near Auckland City, and classified as without eggs, with eggs, with eggs hatching, with eggs hatched, or dead. The findings are shown in a table. They indicate that most females began to produce eggs in January or February, but a small percentage were still without eggs in March and April and on 2nd May in 1941. The percentage of scales with unhatched eggs rose from December to a peak in February in each year and then declined until the beginning of May. Hatching began early in February, about 50 days after the first eggs were produced, and was completed in some three weeks in individual scales and in about three months for the entire generation. The percentage of live adults was high until the end of February and declined from then until May, when practically no adults could be found. The crawlers were first noticed on the leaves in February.

ULLYETT (G. C.). **The Control of the Small Cabbage Moth.**—*Fmg in S. Afr.* 1943 repr. no. 112, 2 pp. Pretoria, 1943.

Investigations over a period of six years on the factors responsible for the natural mortality of *Plutella maculipennis*, Curt., on market-garden crucifers in South Africa [*cf.* *R.A.E.*, A **31** 296; **32** 87] have produced results bearing directly on the control of this pest, and measures based on them are being tested. In view of the importance of these crops under war-time conditions, however, one recommendation that has been found of value is given here.

Parasites and predators can control 90 per cent. of the larvae under favourable conditions, but in years when they fail, chemical control measures become necessary. The plants are most susceptible to attack during the three weeks following planting out from the seed-bed, and in this period a low population, which may pass unnoticed, may cause damage that will seriously affect subsequent growth. Dipping the seedlings as they are taken from the seed-bed in a well-stirred mixture of 3 oz. lead arsenate and ½ oz. calcium caseinate in 4 gals. water is a protective measure that retains its effectiveness for 2–3 weeks. It is cheaper and more effective than spraying the plants one week after planting out, and causes less mortality among natural enemies, which generally become established in the crop at a later date. The seed-beds should not be treated in any way for as long as possible, as a high infestation concentrated in a small area provides an excellent breeding site for parasites. Except under unusual circumstances, later infestations of *P. maculipennis* can be ignored.

BAPTIST (B. A.). **The Scope and Function of Plant Protection Legislation in Ceylon with special Reference to Insect Pests.**—*Trop. Agriculturist* **99** no. 4 pp. 221–230, 7 refs. Peradeniya, 1943.

This discussion of plant quarantine comprises an account of its general principles and a description of the administrative procedure used in Ceylon for

the exclusion of foreign insect pests, diseases and weeds and the control of indigenous ones. It includes a list of the insects that are declared to be crop pests in Ceylon.

ANANDA RAU (S.). **Report of the Entomologist 1942–43.**—*Rep. Tea sci. Sect. U.P.A.S.I. 1942–43* pp. 10–15. Madras, 1943.

Observations in south Travancore on the duration of the effect of pruning tea to different heights on yield and the incidence of *Helopeltis* were discontinued on the completion of one pruning cycle. High pruning consistently gave the heaviest yields over the whole period, but the influence of pruning on both yield and the incidence of *Helopeltis* was not significant [*cf. R.A.E.*, A **31** 452]. Branches pruned at 30 ins., but not cleaned, did not give increased yields after the first year, unlike those receiving the other treatments. The growth of *Maesa* sp. planted in the vicinity of tea as a trap-plant for *Helopeltis* was rather slow and was further retarded by the attacks of the bug. Infestation of tea by the shot-hole borer [*Xyleborus fornicatus*, Eichh.] on an estate in an area in central Travancore in which it had occurred for many years was much heavier than usual; it had not spread outside this area to any extent. A severe attack by a thrips, tentatively identified as *Dendrothrips bispinosus*, Bagn., occurred on an estate at a high altitude in the Nilgiri Hills, when, of the factors regarded as favourable, only drought might have been operative. Numbers became high in September–October, subsided considerably in November and increased again in December. Tea that had been pruned more than 18 months earlier was relatively free from attack, although the succulent growth that follows pruning is not as a rule considered to be favourable for thrips. Populations were apparently not checked by the monsoon rains [October–December]; the decrease in November is attributed to cold weather and the increase in December to unusually warm weather. *D. bispinosus* was recorded on tea in the Nilgiri Hills in 1923 and is probably more prevalent than is supposed. The damage caused by it closely resembles sun-scorch, for which it has probably been mistaken. Nettle-grubs [Limacodids] have not been generally injurious since 1933–34. Other pests recorded on tea during the year include the bark-eating borer [*Indarbela*], which was prevalent on an estate in south Malabar, *Orthacris* sp., *Saissetia coffeae*, Wlk., *Toxoptera aurantii*, Boy., *Anomala gemmula*, Arr., adults of which caused defoliation, *Tenuipalpus obovatus*, Donn., and *Eriophyes carinatus*, Green.

Insects on shade trees for tea included a species of *Stenoscelis*, probably undescribed, that attacked *Grevillea* in Cochin. Injury resulted in the destruction of the cambial tissues of the stem, and it is not known whether this weevil is a primary pest. The only pest recorded on *Albizzia moluccana* during the year was *Terias* sp. Red gum [*Eucalyptus rostrata*] in Cochin was infested by an unidentified termite that excavated a gallery inside the collar region without attacking the external wood. Damage by this species, which had not previously been observed, was associated with the growth of callus tissue in the collar region. Damage by other termites was slight.

ACATAY (A.). **Istanbul çevresi ve bilhassa Belgrad Ormanındaki zararlı orman böcekleri, mücadeleleri ve işletme üzerine tesirleri.** [Insect Pests of Forests in the Environs of Istanbul and especially in the Belgrade Forest, their Control and Effect on Forestry.]—*Calişmalar yüksek Ziraat Enst. Ankara* no. 142, [8+] 163 pp., 64 figs., 30 refs. Ankara, 1943. (With a Summary in German.)

Records are given of the finding of some 200 species of insects and mites in the Belgrade Forest near Istanbul during a survey in 1939–40, with notes on the biology of some of them and suggestions for their control. It is pointed out

that their biology differs in some cases from that in Europe and *Paranthrene* (*Sciapteron*) *tabaniformis*, Rott., which is a fairly serious pest of poplars, and *Phalera bucephala*, L., are cited as examples.

ROEBUCK (A.) & BRAY (S. P. V.). **The Effect of Altitude on the Distribution of Elateridae in Grassland in Derbyshire.**—*Northw. Nat.* **19** no. 1–2 pp. 47–50, 1 graph. Arbroath, 1944.

In wireworm surveys of grassland in lowlands in Derbyshire and neighbouring counties in recent years, larvae of the genus *Agriotes* were so predominant that the few others were simply noted as "other genera." When, however, the uplands were surveyed, it was found that the other genera largely outnumbered *Agriotes*. Farmers who had lived both in the valleys and in the uplands knew this fact and contrasted the damage by the black-backed wireworms (*Corymbites*) of the uplands with that by the yellow wireworms (*Agriotes*) in the valleys. A table is given showing the average populations at various altitudes of *Agriotes*, *Athous*, *Corymbites*, *Hypnoidus* (*Cryptohypnus*) and *Limonius*. Above 1,000 ft. *Corymbites* was the most abundant, but up to this *Agriotes* predominated. The average wireworm population per acre fell with altitude from 612,000 in fields below 400 ft. to 229,000 above 1,000 ft.

OSSIANNILSSON (F.). **Bladlöss som spridare av bladrullsjuka på potatis i Sverige.** [Aphids as Vectors of Leaf-roll Disease of Potato in Sweden.]—*Växtskyddsnotiser* 1944 no. 1 pp. 15–16. Stockholm, 1944.

Following investigations in Sweden on the species of Aphids present on potato [*R.A.E.*, A **31** 438], tests were carried out to ascertain which of them are vectors of the virus of leaf-roll [*Corium solani* of Holmes]. Of those tested, only *Myzus* (*Myzodes*) *persicae*, Sulz., and *Macrosiphum solani*, Kalt. (*Aulacorthum pseudosolani*, Theo.) have so far given positive results. Both these Aphids transmit the virus in other countries, and their actual importance as vectors in Sweden will depend on their frequency in potato fields.

AHLBERG (O.). **Arsenikföreningars användning inom växtskyddet.** [The Use of arsenical Compounds in Plant Protection.]—*Växtskyddsnotiser* 1944 no. 2 pp. 17–19. Stockholm, 1944.

This is a review of the revised regulations that came into force in Sweden on 1st March 1944 on the use of arsenical compounds in so far as they concern their employment in plant protection. Arsenicals may be purchased only in unbroken containers bearing instructions for use and the prevention of accidental poisoning. They may not be applied to fruit trees, etc., during the blossoming period (to avoid injury to honey bees) or within 30 days of harvest, to cau iflowers after the head has begun to develop, or to fodder plants within 30 days of cutting, and they may not be used at all on plants with edible leaves, such as lettuce, spinach or cabbage. Operators must wear protective clothing and have the mouth and nose covered. Empty containers and spray tanks must be cleaned after use or otherwise disposed of. If arsenicals are used for the destruction of ants, care is to be taken to avoid da ge. to man, domestic animals and bees.

MATHLEIN (R.). **Ovälkomna invandrare.** [Unwelcome Immigrants.]—*Växtskyddsnotiser* 1944 no. 2 pp. 23–28, 7 figs. Stockholm, 1944.

Cargoes of foodstuffs received in Sweden since the outbreak of war have in many cases been infested by insects that might become serious pests of stored foods if they established t. em e.ves there. The examples given are *Calandra oryzae*, L., *Rhizopertha dominica*, F., and *Laemophloeus ferrugineus*, Steph.,

in wheat, *Latheticus oryzae*, Waterh., which is a secondary pest, attacking damaged wheat grains, and *Bruchus* (*Bruchidius*) *obtectus*, Say, in beans. Brief notes on the bionomics of these beetles are included. In experiments on control, all developmental stages of the Bruchid were killed by exposure to 0°C. [32°F.] for 6–7 weeks and to −2°C. [28·4°F.] for 4 weeks. When infested beans were kept in an unheated cellar from October 1943 to March 1944, the infestation died out, though the temperature was never lower than 2°C. [35·6°F.] and was usually about 5°C. [41°F.].

KEMNER (N. A.). **Den lilla fruktbaggen,** *Carpophilus hemipterus* **L. som snyltare i socker i Malmö.** [The Small Fruit-beetle, *C. hemipterus*, as a Pest of Sugar in Malmö.]—*Opusc. ent.* **9** no. 1–2 pp. 50–52. Lund, 1944.

The author reviews the information noticed in the preceding abstract and states that in October 1943 *Carpophilus hemipterus*, L., was found in a shop in Malmö infesting castor sugar that had been produced in Sweden. Examination of the wooden bins in which the sugar was stored showed that *Cryptophagus subfumatus*, Kraatz, and *C. pseudodentatus*, Bruce, were also present. It is considered impossible that the sugar was infested when it left the refinery, as the processes involved would not permit the survival of insects. *Carpophilus hemipterus* is a well known pest of dried fruits, and since it was found at about the same time in a large consignment of dried figs in Stockholm, it is thought that it may have reached Malmö in a similar manner.

KLEFBECK (E.). *Thermobia domestica* **Pack. (Thysanura), en för landet ny insekt.** [*T. domestica*, a new Insect for Sweden.]—*Opusc. ent.* **9** no. 1–2 p. 55. Lund, 1944.

Thermobia domestica, Pack., was common in 1941 in a paper works in central Sweden, a country from which it had not previously been recorded. It has also recently been observed in Finland.

OXLEY (T. A.). **A simple gasometric Apparatus for Estimation of Carbon Dioxide.**—*Chem. & Industr.* **63** no. 3 pp. 24–25, 2 figs. London, 1944.

The author describes apparatus designed to determine the concentration of carbon dioxide that develops in the intergranular spaces of samples of grain kept under standard conditions, as a basis for estimating the degree of insect infestation [*cf. R.A.E.*, A **32** 243], with detailed instructions on its use.

PAPERS NOTICED BY TITLE ONLY.

CHERIAN (M. C.) & MARGABANDHU (V.). **A new Species of** *Trichospilus* **(Hym : Chalcidoidea) from South India** [*T. diatraeae*, sp. n., from pupae of *Proceras* (*Diatraea*) *venosatus*, Wlk.].—*Indian J. Ent.* **4** pt. 2 pp. 101–102, 2 figs., 1 ref. New Delhi, 1942. [Recd. 1944.]

BRYANT (G. E.). **New Species of South American and West Indian Chrysomelidae (Halticinae, Col.)** [including *Crepidodera insularis* on sugar-cane in Trinidad]. —*Ann. Mag. nat. Hist.* (11) **11** no. 80 pp. 551–558, 9 figs. London, 1944.

NEWCOMER (E. J.). **Orchard Insects of the Pacific Northwest and their Control.** —*Circ. U.S. Dep. Agric.* no. 270 (revd.), 80 pp., 83 figs., 1 ref. Washington, D.C., 1942. [Recd. 1944.] [*Cf. R.A.E.*, A **22** 29 ; **32** 352.]

KNOWLTON (G. F.). **Poisoning of Honeybees** [by insecticides, etc.]. **Abstract of selected References from the Literature.**—*Mimeograph Ser. Utah agric. Exp. Sta.* no. 310, 11 pp., 66 refs. [Logan, Utah] 1944.

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CONTENTS.

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by the South Essex Recorders, Ltd., Ilford.

(1284) Wt. P12/1166 1/45 S.E.R. Ltd Gp. 432.